

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 81

Number 7

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Cable Address Autoland, Philadelphia

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly). May, 1902; Dealer and Repairman (monthly), October, 1903, the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

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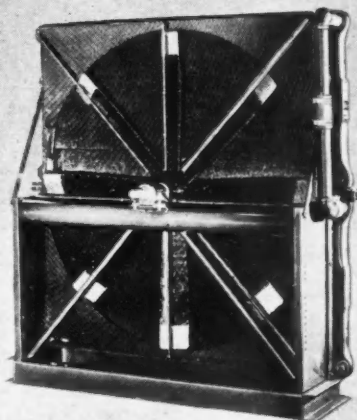
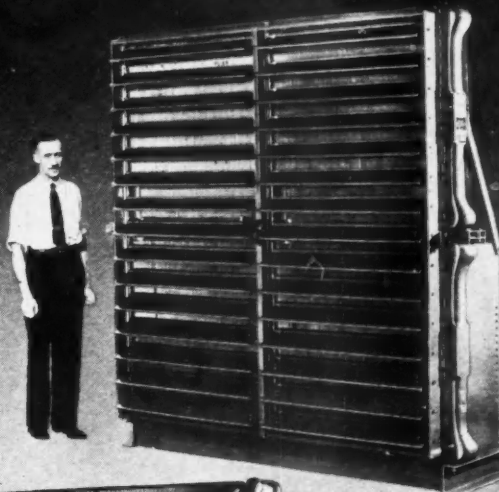
Automotive Industries

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October 1, 1939

AUTOMOTIVE INDUSTRIES, Vol. 81, No. 7, Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. Entered as Second-Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In Case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, \$1.00 per year. Canadian and Foreign, \$2.00 per year; single copies, 25 cents, except Statistical Issue (Feb. 25, 1939), 50 cents.

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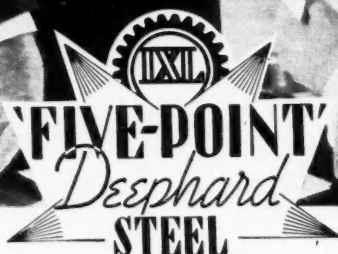
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AUTOMOTIVE INDUSTRIES

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Vol. 81, No. 7
October 1, 1939

Triumvirate For Achievement

By HARLOW H. CURTICE*

WITH the announcement of 1940 car models is repeated the "annual miracle" of plant modernization and improved production technique. By now, even the most casual car buyer has some perception of the vast and rapid production changes made necessary by model changes, some slight idea of the problems perplexing the car manufacturers, the parts makers and the machine tool builders. What is perhaps not quite so obvious is the increasingly important part played in the automotive scheme by the parts and machine tool builders.

Characteristic of the automobile industry is its progressiveness in manufacturing methods, a progressiveness which is at once a source of joy and grief to the machine tool builder. Joy, naturally, because the automobile manufacturer stands always ready to take advantage of the latest developments offered by the machine tool industry. Grief, because the car builder must necessarily turn to the machine tool builder for the answer to many a seemingly impossible problem conceived by a demanding public. The success with which the machine tool industry has solved and is solving the "impossible" is apparent to anyone with knowledge of the changes in car production methods.

The machine tool industry undoubtedly owes much of its existence to the automotive industry—the converse is equally true. This has been proved in numerous ways. Overhead expense, for example, the bug-a-boo of any business, has found in the machine tool industry a virulent enemy—witness the development of new type unit-machines which can be tooled up to function for special purpose jobs, yet have sufficient flexibility to permit changeover to entirely different operations, thus making possible lower depreciation rates as only tooling and fixtures need be depreciated over short periods.

Cooperation of the machine tool builders with the car manufacturers has been excellent always. In 1937, as an instance, Buick built a new transmission plant. The production men in charge were "on their own"—free to develop procedures and buy special equipment

that would put the new self-shifting transmission on a production basis. The Buick staff had no previous experience from which to draw because of the entirely new elements in many parts of the transmission.

When a preliminary routing for each part had been made, and indications were that special equipment had to be developed for several operations, the Buick staff drew on the mechanical talents and the wide production experience of the machine tool builders. Certain parts were turned over to experts in their respective fields with the request for an analysis of the job and

**Car Manufacturer . . . Parts
Maker . . Machine Tool Builder
- - Pool Their Skill for Profits**



* General Manager, Buick Division, General Motors Sales Corp. As told to Herbert Hosking, editor, AUTOMOTIVE INDUSTRIES.

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GENERAL

specific recommendations for special equipment and tooling. The final layout represented the product of intensive study and planning. It was unique to the extent that much of the equipment was new or novel and designed to produce results based on the engineering drawings.

Thus a particularly difficult job was brought down to commercial reality through the cooperation of machinery builders. We believe it may be taken as a classic example of the role of the machine builder in the automotive world. Factory men in pooling their skill with that of the machine tool industry appear to find no end to the process of simplifying and expediting operations.

Parts makers, the thousands of suppliers to the assembly lines of the builders of cars, have an economic significance which is not generally realized. Automobile parts makers rest in the uncomfortable position of being largely dependent on the car manufacturers' activity for their livelihood. Reflecting on them is the ebb and flow of retail sales, the seasonal see-saws and the consistent changes in style preference.

As they are dependent on the automobile manufacturer, so is the car builder dependent on them. Worthy of admiration is the high degree of flexibility the parts makers must achieve, and do achieve, in their production methods and operations in order to be quickly responsive to changes in both the volume and character of the demand for their products.

Probably the most striking feature of the parts industry is the great amount of research activity which continues year after year regardless of business conditions. Covering every type of product this research has been called the very essence of automotive progress and it forms a vital part of the base on which better automobile performance rests.

The cooperation and flexibility of the machine tool and parts makers has helped make possible longer range programs for the manufacturer. In the automobile business we attempt to gage the long range automobile market. We study economic trends and the variety of influencing factors in an effort

to arrive at what the market will be. On the basis of these studies, and the information thus assembled, our manufacturing programs for new model years are set up.

The spectacular expansion in retail volume of the Buick division of General Motors Corp. during the past five years has been one of the outstanding examples of progress in the automobile industry. In that time Buick's sales and manufacturing volume has stepped up from approximately 40,000 cars annually in 1932 and 1933 to better than 200,000 cars this year and a peak of over 230,000 in 1937, the best year the industry has experienced since depression days.

To accomplish this rise Buick inaugurated in 1934 a comprehensive program of product improvement and revitalization, plant rehabilitation and expansion which drew widely upon the products and experience of the parts and machine tool builders. Buick has spent approximately \$50,000,000 in plant expansion, rearrangement, retooling and installation of new machinery and equipment to meet new capacity requirements and thoroughly to modernize the great plants at Flint. The planned program of rehabilitation included not only reconstruction and renovation from the point of plant facilities, but also a product program which was to bring Buick sales volume and production from the low levels of 1932 and 1933 to nearly an all-time record in 1937.

The product program involved revising Buick's price

class with the introduction of a Buick car in the less than \$1,000 price field and the complete revitalization of the product along the most modern lines of engineering and design. The result was a steady climb in volume and the recapture by the famous Buick name of all the former prestige held as one of the outstanding producers in the automobile industry.

Buick's spectacular rise was not guess work. It was a planned result of a carefully planned manufacturing and sales program. A tremendous plant needed repairs and renovation; a line of automobiles designed to sell in a price class in which there was only a small potential needed re-vamping and a man- (Turn to page 419)

The Brass-Hat Rack.



"He's all hepped up about public relations this year!"

BUSINESS IN BRIEF

*Our own view of automotive production and sales;
authoritative interpretation of general conditions*

PRODUCTION of cars and trucks in September amounted to approximately 180,000 units, almost exactly double the production of September, 1938, which reached a total of 89,623 units.

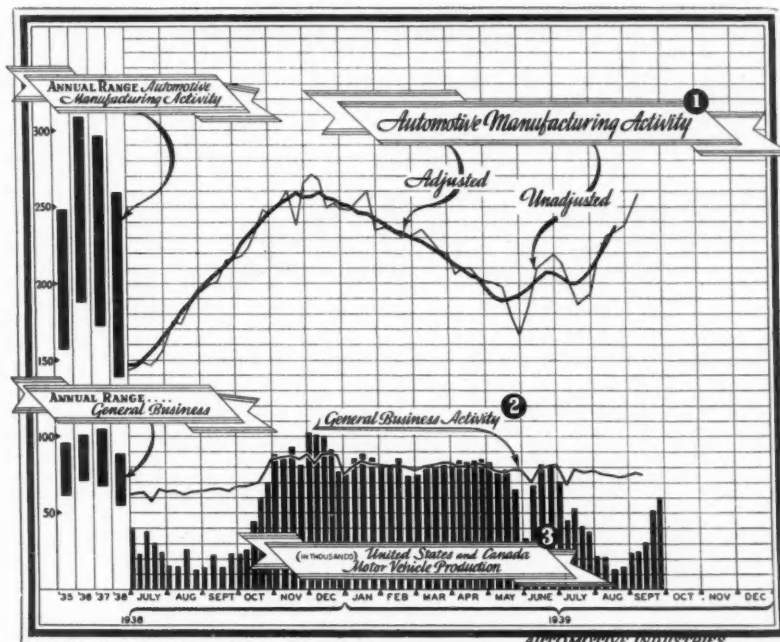
While much of this current gain can be attributed to the fact that new model announcements came earlier, it also represents manufacturers' estimates of improved sales, as a number of major producers have projected schedules to the end of the year which will show increases ranging from 20 to 25 per cent ahead of a year ago.

Car and truck production during the week ending Sept. 23 showed important gains over the previous week with a check of factory schedules indicating that the total would be approximately 51,500 units. Output during the final week of the month is expected to crowd 60,000 to bring the monthly figure up to almost 180,000. All major producers showed steadily increasing assembly totals with Chevrolet adding its bit to the General Motors' total by getting underway on its 1940 models. Independents also showed increases with Nash going to six days to make up for time lost during the Bendix strike.

AUTOMOTIVE MANUFACTURING ACTIVITY surged upward in the weeks ended Sept. 9 and Sept. 16 to unadjusted index levels of 248 and 258, respectively. The adjusted index reached 227 in the week ended Aug. 19 and climbed 11 points to 238 in the week ended Aug. 26.

GENERAL BUSINESS ACTIVITY: The business index of the *Journal of Commerce* for the week ended

¹1923 average = 100; ²Prepared by Administrative and Research Corp., New York. 1926 = 100; ³Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES. ⁴Summarized for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co. of New York.



Weekly indexes of automotive general business charted

September Doubles 1938 Tally

Sept. 9, reflecting the influence of a holiday, declined to 90.1 from 94.4 for the week before, as compared with 77.4 a year ago. The *New York Times* seasonally adjusted index for the same week advanced three points to 97 per cent of estimated normal.

Railway freight loadings during the week ended Sept. 9 declined 7.5 per cent from the total for the week preceding Labor Day, but the number of cars loaded, 667,409, was 17.4 per cent more than the total a year ago.

Production of electricity by the light and power industry during

the same period extended its advance over the comparable 1938 output to 11.8 per cent from 9.7 per cent shown for the week before.

Production of crude oil in the week ended Sept. 9 rose to an average of 3,228,650 barrels daily, or 8 per cent less than current requirements, as computed by the Bureau of Mines, as against 1,690,800 barrels a fortnight earlier.

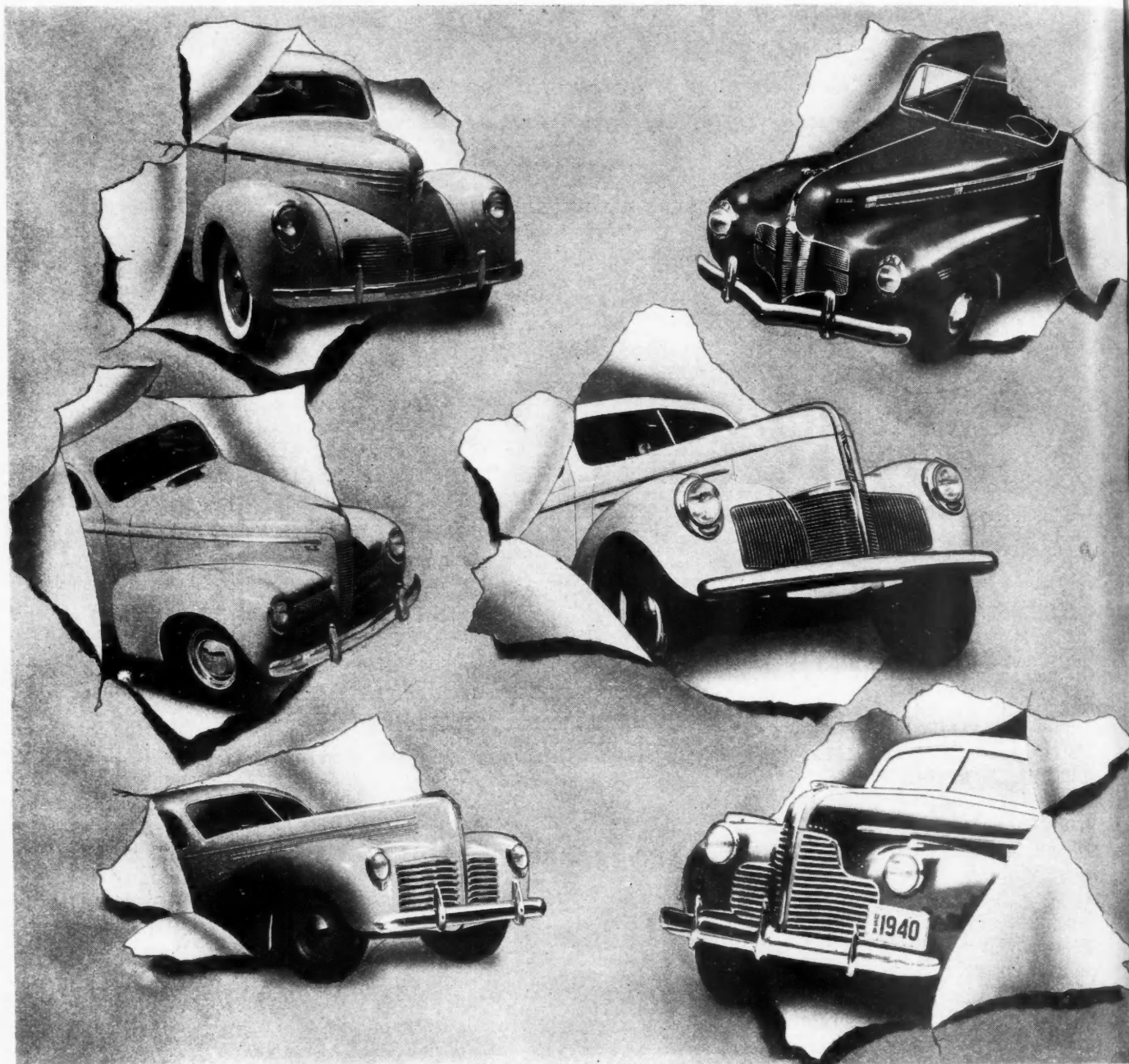
Bituminous coal production during the same week averaged 1,510,000 tons daily, as compared with 1,350,000 tons for the week before and 1,278,000 tons a year ago.

Professor Fisher's index of wholesale commodity prices rose in the week ended Sept. 15 to 82.5 per cent of the 1926 average, a new 1939 peak.

Excess reserves of member banks of the Federal Reserve System rose \$300,000,000 during the week ended Sept. 13 to an estimated total of \$5,270,000,000.

Because of current inability to obtain the necessary commodity price data from certain important countries, publication of the General Motors-Cornell World Price Index of 40 basic commodities has been temporarily suspended.

BUSINESS ACTIVITY



1940 Cars Come

Two outstanding recent technical developments with which the general public will become acquainted first through the 1940 models of American passenger cars are the "sealed-beam" type of headlamp and the new Hi-Test safety glass. Both will be found on practically all cars turned out next year. In the case of the headlamp this instant popularity resulted from the fact that it represents a cooperative development which was sponsored by organizations of automobile manu-

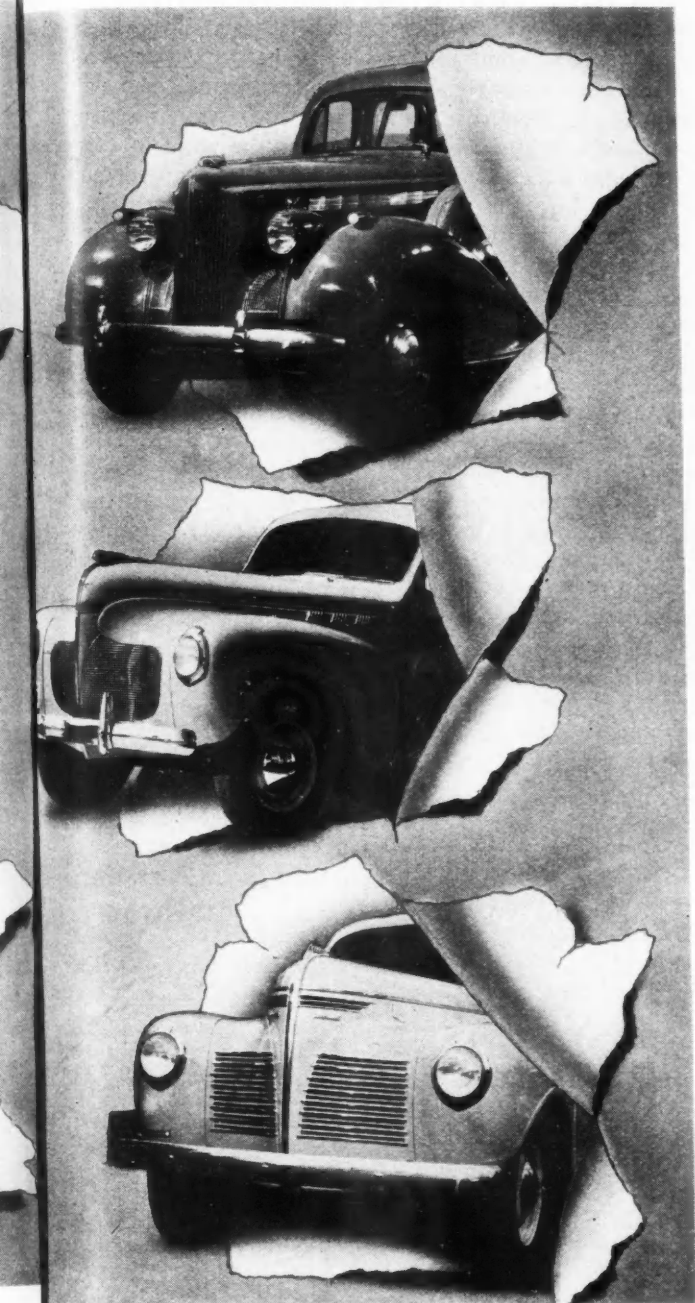
By P. M. HELDT

facturers, motor vehicle administrators, and the safety movement; in that of the safety glass the probable reason is that the sources of supply of such glass are few.

Wheelbases have been increased on several models, including all Chrysler lines, the Pontiac eight, and two Oldsmobile models. There are no examples of a change in the opposite direction, and apparently a change to smaller cars could be brought about only by bringing out entirely new designs. The feeling seems to be that

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duces only three different engines. In another case, where five different lines are offered—sixes and eights—the program includes three different engines, but the bores of all engines are alike, so that it is most likely that all five lines carry pistons, piston rings, piston pins, valves, etc., that are interchangeable among each other. A manufacturer of a low-priced car who last year introduced a second line by “hotting up” the engine and making some changes in the equipment, this year offers three lines, all on the same basic chassis.

Another example of production standardization is furnished by Oldsmobile, which equips its cars optionally with three-speed synchromesh and four-speed automatic transmissions, which normally would be of different lengths. In order to make it possible to use the same propeller shafts on all cars, the three-speed transmissions are provided with an extension on the rear bearing.

The only entirely new engine this year seems to be that of the Packard Custom Eight, which replaces the Packard Twelve. It follows the well-established Packard 120 engine in general design, but differs from it in having main bearings between each pair of adjacent crank throws, and in being provided with no-lash valve tappets. Packard and Pontiac have revised their combustion-chamber designs, and Pontiac increased its compression ratio slightly. There have been no increases in cylinder dimensions this year, and where the engine rating has been increased it has been made possible by refinement in design, such as increases in the compression ratio, the carburetor-throat diameter, or the valve lift. Several relatively new production processes find wider application in engine manufacture this year. The Chrysler method of super-finishing is applied to vital parts of the Plymouth engine for the first time; Pontiac “granodizes” the valve lifters, and the aluminum alloy pistons of the Plymouth are tin-plated.

Changes in the fuel system for the most part are of a minor character. To what length engineers go nowadays in their efforts to eliminate unpleasant noises is illustrated by the fact that Buick now incorporates a section of neoprene hose in the fuel line

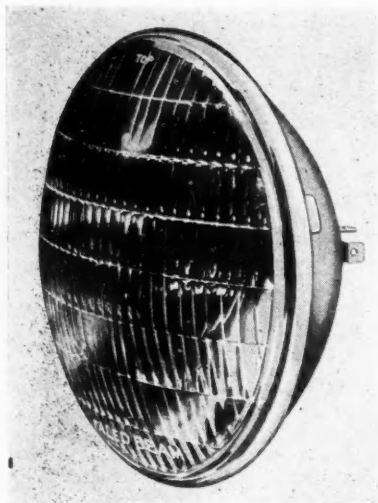
Through

if the wheelbase of a going model were reduced, the buying public would regard it as a retrograde step.

A tendency which, while not exactly new, receives additional emphasis this year, is for car manufacturers to offer to the public a considerable number of different lines of cars but to keep the number of different basic units down to a minimum. This evidently is intended to widen the sales appeal and at the same time to hold down manufacturing costs. As an example, one manufacturer this year offers seven different lines but pro-

with “sealed beam” type of head-lamps, longer wheel bases on some lines, and general refining influence in body design. There is only one entirely new engine in the 1940 offerings, but others have been generally revised for increased power and service.

NEW CARS



Sealed - beam head lamp which combines light source, reflector and lens in one unit.

to damp out noises due to the fuel pump. Quite a number of engines now are slightly inclined on the chassis to give a practically straight-line drive. With the conventional inlet manifold, in which the trunk is parallel with the outlets of the branches, this inclines the trunk, which seems to have an unfavorable influence on the distribution. To overcome this difficulty, Cadillac this year has redesigned the manifold of one of its engines, to bring the trunk horizontal, with the car on level ground. Buick has made some changes in the "stove" of its automatic choke. A tube of the heat-resistant alloy, Inconel, is fitted into the exhaust manifold valve inlet. Moreover, a "blocking cam" has been added which automatically positions the accelerator pedal for starting.

Several manufacturers have increased their generator capacity, apparently without increasing the size of the generator. Vacuum spark control is making its way, and has been added on one or more models by Hudson, Cadillac and Oldsmobile this year. New practices in automotive electrical equipment are the silver-plating of terminals exposed to the weather, by Hudson, and the use of glass insulation on armature windings, by Cadillac.

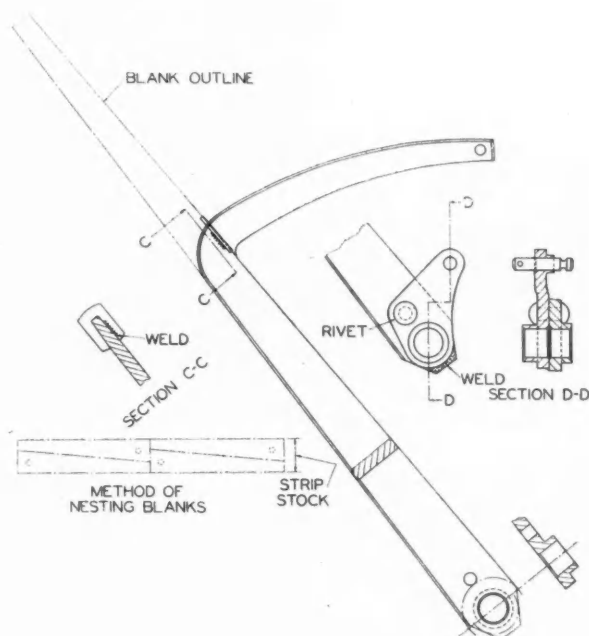
Oil filters appear as standard equipment on a number of additional models this year. On the new Packard equipped with zero-lash tappets there is a filter in the oil line to these tappets, so that only freshly-filtered oil can get into them. This filter acts as a by-pass filter for the engine-lubricating system.

Mufflers have come in for some attention during the past year. Buick now makes them of lead-coated sheet steel (terne plate) to make them rust-proof, and therefore more durable, and Cadillac now places a tuning chamber on the muffler inlet as well as on the outlet pipe. Buick, following the lead of several other makers, now operates its cooling system under pressure, the relief valve being set to open at 7 lb. per sq. in. This permits of operating the engine at higher temperatures, thereby increasing its efficiency; it prevents the loss of alcohol from the cooling system by evaporation in winter time, and it makes the car heater more effective.

Cadillac this year has joined the car manufacturers who use the semi-centrifugal clutch, which reduces the

pedal pressure required for clutch release. Two other principles now employed to reduce the pedal pressure are the use of an over-center counter spring, and the use of a variable-rate spring in which the pressure increases with the compression up to the point of full clutch engagement, but is reduced as the compression is increased further. A new make of clutch, the Atwood, has made its appearance in the passenger-car field and is fitted on the Willys. While of the single-plate type, it embodies features of design which seem to make for economical production.

Packard this year uses pressed-steel clutch and brake pedals developed by the A. O. Smith Company. A drawing of one of these pedals is reproduced herewith. In the past, these pedals usually were drop forged. The drawing illustrates some of the details of the production process. One of the most interesting features is that the hub or bearing is not a piece of tubing welded in place, but is produced by a method developed at the A. O. Smith plant, for extruding embossments out of flat plates. This same method of construction is used in the production of the pressed-steel control arms of front independent suspensions, and is said to be the primary reason why pressed-steel pedals can be made cheaper than drop-forged ones. In the brake pedal, the small bearing for holding the pin to which the link to the master-cylinder is attached, is also produced by extrusion. The lower halves are held



Packard pressed-steel brake pedal.

together by both a weld and a rivet, the rivet giving assurance against failure in the case of a faulty weld. The reason for the weld is that it makes it possible to get along with less material in the pedal halves than would be necessary if two rivets were used. The clutch pedal carries very little load, and for this reason no
(Turn to page 411, please)

AUTOMOTIVE INDUSTRIES

Just among Ourselves

A Trade Policy of Common Sense

INTERRUPTED communications and trade throughout the world are symbolized by a laconic note which just passed across the desk. Due to inability to obtain the necessary data, the General Motors-Cornell Index of World Prices is temporarily suspended.

With the same hour, one of our favorite British publications in the financial field arrived as usual—except that it was about half its usual fatness and you could sense in the text the labored breathing of the editors struggling to carry on under a staggering burden of emergency-induced difficulties.

Under the conditions which such straws indicate, the eyes of American industry turn naturally to the comparatively quiet terrain of Panamerica. The "good neighbor policy" is being dusted off and treated to a face washing. Undersecretary of State Sumner Welles is in Panama for a conference on Panamerican neutrality. The countries behind the Golden Wall are creeping closer together for the sake of the benign warmth of community effort.

BBETTER South American markets are expected. So much better that the Automotive Export Club of New York finds it desirable to suggest to its members that relations with old-established customers in remaining export markets should not be jeopardized by rushing to fill the wants of mushroom outlets that are expected to spring up to leeward of the war winds. Such a policy sounds like common sense, and should serve to stabilize some of the useless rusharound which is likely to accompany a rapid expansion of trade in a single direction.

WE present without comment some figures of automotive interest which belong to the history of "last time."

In 1913 the United States exported 28,000 motor vehicles; in 1914 the number was about the same. In 1915 exports doubled to 67,000, and in 1916 the figure was 85,000.

The total foreign consumption of U. S. designed vehicles reached even higher totals.

Registration figures on domestic passenger cars don't extend back that far.

The domestic motor vehicle production figures for the five years 1913 to 1917 run as follows: 485,000; 569,054; 969,930; 1,617,708; and 1,873,949.—HERBERT HOSKING.

Automotive Industries



These hair styles were inspired by 1940 car styles, but this one owes a bow to Valasquez too. The one below . . .



. . . also made by Mr. Josef, under the direction of Mme. Helena Rubenstein is described as "ideal coiffure for the modern woman."

ALTHOUGH there have been relatively few completely new programs for the 1940 season, the past year in retrospect has been prominent for the erection and mechanization of many new automotive plants. Early in August, Packard announced the completion of its most ambitious program in which the '40 lines will be built in a self-contained machine shop, assembled on the same conveyor lines, filling the entire plant on one side of East Grand Boulevard exclusively for the manufacture of its line of all-steel bodies.

Earlier this year, Studebaker placed in operation the new plant facilities for producing the Champion car. As described in *AUTOMOTIVE INDUSTRIES* at the time, the machine shops for the Champion represent the very latest equipment and techniques known in the industry.

Another striking manufacturing enterprise is the plant for the production of General Motors automatic transmissions. In machine shop facilities it represents the combination of much of the equipment originally installed at Buick for the production of the early self-shifting transmission, augmented by new equipment valued at around \$2,000,000. In product it will represent an entirely new automatic transmission.

Obviously it would be quite impossible to touch on the details of all plant changes made in the industry for the coming season; nor would it be practical to cover even sketchily the gamut of changes and new developments effected in the machine tools now on the market. It is possible, however, to discuss the broad field of mechanization and in a general way to touch on the spheres of activity that have been facilitated and refined by the machine tool industry.

It seems evident that the current year will go down in the archives as marking the most important advances in the art of metal stretching in a long time. We have grown quite accustomed to the huge body shell stampings, the immense turret top stampings. But bodies are coming still larger and promise startling developments for 1941. One of the most impressive achievements of the metal stretching art is the new Buick front fender. If you could look at it in the white, you would find that a single stamping encompasses the entire new fender with its large splasher, includes the headlamp housing and hood side as well. This is but one example to indicate not only the advance in die design but the amazing development of deep drawing steels which make possible such feats of metal stretching.

As usual, an examination of the new cars will reveal the unceasing battle of competitive methods of fabrication—die castings competing with stampings and plastics, plastics overwhelming certain types of sheet metal applications, drop forgings replacing stampings in some places while heavy stampings replace forgings in other places. As an example of the latter, we find that Packard has adopted the A. O. Smith-inspired stamped clutch and brake pedals. Too, both Nash and Hudson, in adopting coil spring knee-action suspensions at the front, are using A. O. Smith stamped arms instead of conventional forgings.

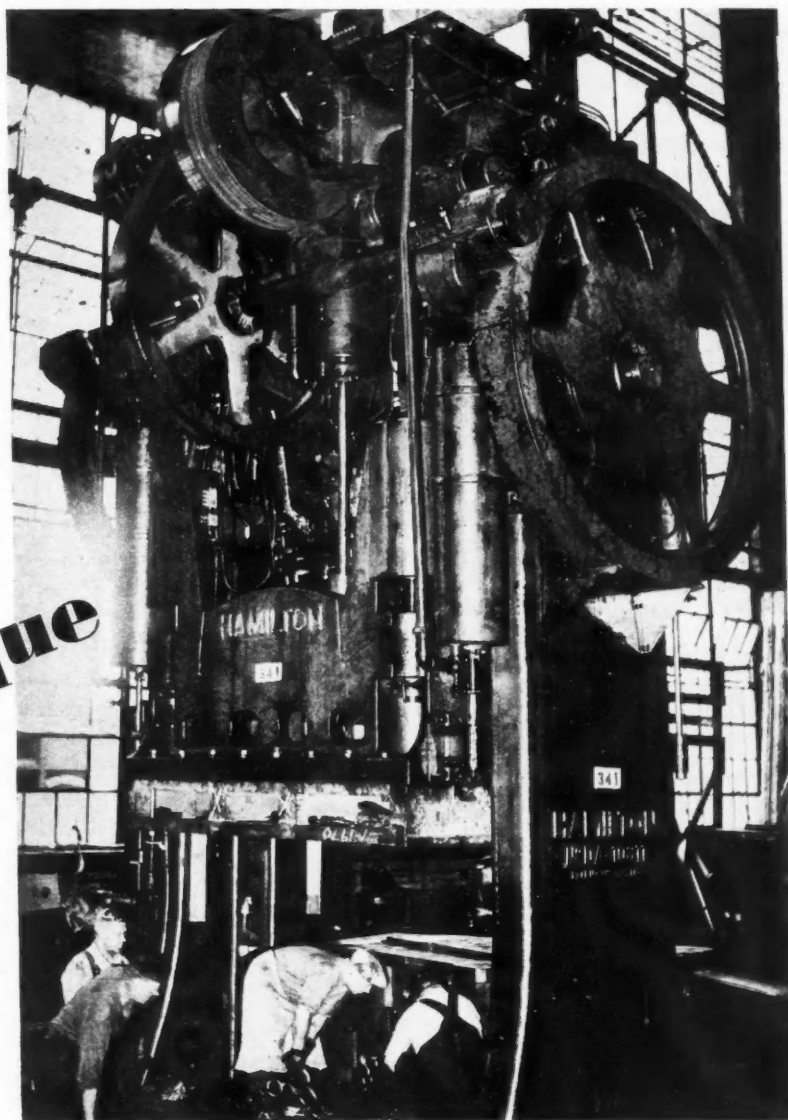
Superfinish, the new technique for producing mating surfaces of exceedingly fine finish and homogeneity, needs no explanation at this time. Interestingly enough, Superfinish and its early applications are the product of an automobile manufacturer—Chrysler

1940 Stretches Manufacturing

Corp.,—rather than the machine tool industry, although its future growth will depend upon the energy with which the machinery builders will develop its possibilities. At the moment it would be difficult to predict either the limitations or possible new applications of the process.

Surface broaching which has excited our admiration since its first beginnings in the industry has been growing apace both in usefulness and production economy. Many routine operations performed on milling machines from time immemorial are now routine surface broaching jobs. More recently, an aggressive organization such as Cincinnati Milling has successfully tackled the development and installation of the huge cylinder block broaching machines and cylinder head broaching machines. The application of the process is a matter of simple economics. With the growing use of flexible, single-ram machines, surface broaching promises to find wide use even in the smaller establishments where multiple-lot rather than mass production is the rule.

The practicability of making "quiet" long-lived gear sets in mass production no longer is a moot question what with the availability of modern gear cutting and



Technique

gear finishing methods. Given properly fabricated gear blanks of the right metallurgical character, prevailing practice is to hob or shape the gear teeth—sometimes a combination of the two—then to correct the form by shaving before heat treatment. In some cases, particularly on gears of larger diameter, heat treatment is followed by lapping. Although gear grinding no longer is practiced in passenger car production, it is still regular procedure on many makes of heavy-duty transmissions where the sheer bulk of metal makes it impossible to control fire-distortion.

Precision boring is well entrenched as a unique method for producing bores that are round, perfectly straight, accurately aligned, finished to extremely close limits. Applications range from cylinder bores to wrist pin bushings. Widest usefulness of the process has been encouraged by the excellent flexibility of well-known makes of machines, permitting the adoption of this type of equipment even in multiple-lot work for a variety of different parts.

Grinding in all of its ramifications—surface grinding, external, internal, centerless, and their variations or combinations—has remained unchallenged in its logical sphere. Grinding machine producers, in common

It seems evident that the current year will go down in the archives as marking the most important advancement in the art of metal stretching in a long time. One of the most impressive achievements is the Buick front fender. It demonstrates not only the advance in die design but the development of deep drawing steels which make such feats possible

with other progressive elements, have made consistent improvements in the equipment and its operation with particularly noteworthy strides in the field of camshaft and crankshaft grinding.

Honing of cylinder bores and of a variety of other holes requiring excellence of finish and roundness and alignment has made notable progress due to improvements in equipment and tooling. Greater econ-

(Turn to page 410, please)

SUPPLEMENTING its well-known series of cars with two new models, Buick offers six different lines for 1940, with 22 different bodies. The complete line comprises the following: the Series 40, of 121-in. wheelbase (one inch longer than last year); a new Series 50, of 121-in. wheelbase, with the new streamlined body styling; Series 60, of 126-in. wheelbase; a new Series 70, of 126-in. wheelbase, with the same body and styling as the Series 50; Series 80, of 133-in. wheelbase, and Series 90, of 140-in. wheelbase. The two new series—the Super Series 50 and Roadmaster Series 70—feature new streamlined bodies, lower and wider than previous models, without running boards. They are available in two body types, a five-passenger four-door touring sedan, and a sport coupe with full-width rear seat. With the exception of the frames, the new series have chassis units similar to those of the corresponding standard lines.

Front styling and sheet metal, which are new on all models, follow the style set in Series 50 and 70. The cars have a huge one-piece front-fender construction, embracing the full fender, headlamp housing, and entire hood side in a single stamping. Radiator grilles are redesigned to conform to the new metal modeling, with 13 horizontal bars that are wider and heavier.

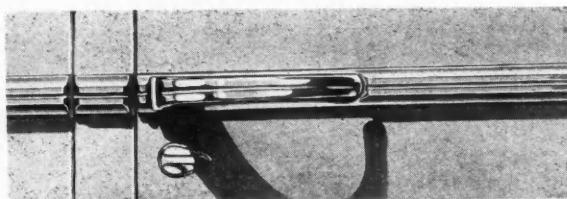
New mechanical and equipment features this year include sealed-beam headlamps; directional signal as standard equipment, operating pairs of parking lamps and stop lights on each side; new frames on the 40, 50, 60, and 70; one-piece torque tubes with flange

mounting at the carrier on Series 40, 50, 60 and 70; threaded outer bushings on the lower control arms; a new type of ignition switch mounted on the instrument panel; an improved steering-column gear shift; a longer transverse radius rod, and an added rear stabilizer on the 40, 50, 60 and 70.

Every engine in the line will be fitted with the new AC Klee-Klean oil filter as standard equipment. Each 1940 engine is balanced as a whole after the usual power test and final inspection, the dynamic unbalance being held to very low limits. Under-seat type heaters are standard equipment on the Series 80 and 90, and optional equipment on the others. A new type of tire jack is included in the equipment.

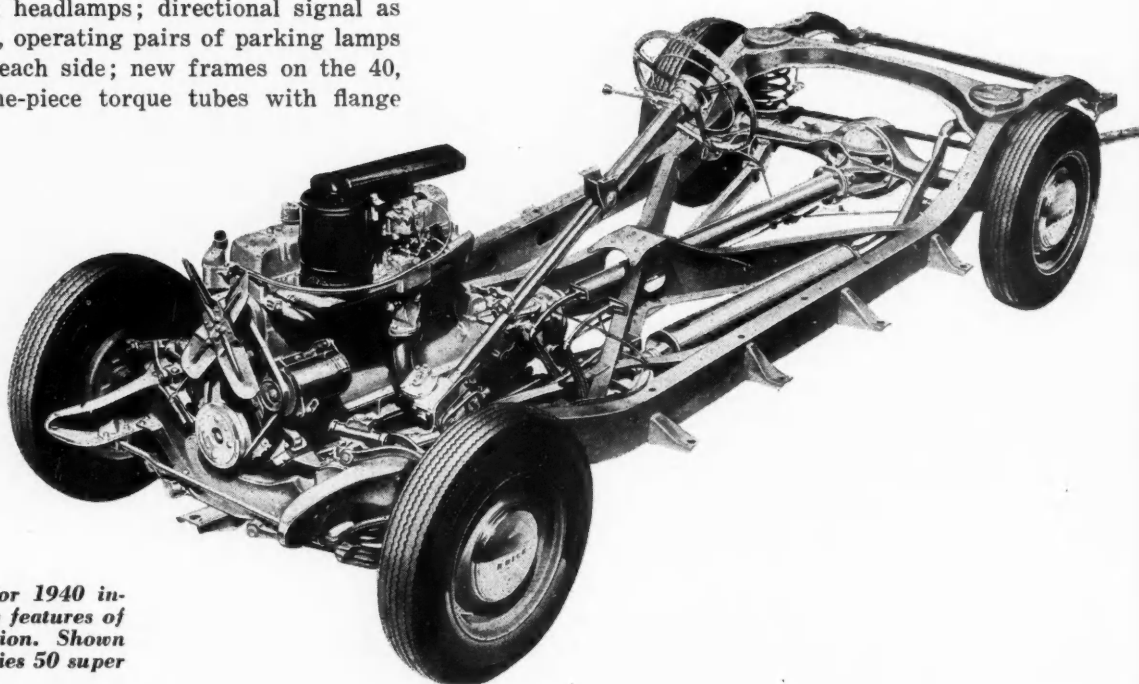
It comprises two separate units, a jack which fits the edge of the wheel rim for lifting, and a large bracket which is slid under the brake backing plate to hold the wheel while the tire is being changed. The jack is removed during this operation; it is used again after the tire has been changed to release the bracket.

Engines retain the same cylinder dimensions and ratings. Series 40 and 50 have a straight-eight valve-



Style development is the design of door handles on the new Buick Series 50 Super and Series 70 Roadmaster cars, which are integral with the chrome body molding.

Buick



The Buick chassis for 1940 incorporates many new features of design and construction. Shown here is the Buick Series 50 super chassis.

in-head engine of 3 3/32-in. bore by 4 1/8-in. stroke (248 cu. in. displacement) rated 107 hp. at 3400 r.p.m., with a compression ratio of 6.1.

Series 60, 70, 80, and 90 have a straight-eight valve-in-head engine of 3 7/16-in. bore by 4 5/16-in. stroke (320 cu. in. displacement) rated 141 hp. at 3600 r.p.m., with a compression ratio of 6.25.

Anodized aluminum-alloy pistons with modified-dome, Turbulator-type heads are continued. The width of the top land on the piston is increased 0.020 in., while that of the second land is increased 0.010 in.

A change has been made to pressure cooling, by the adoption of a radiator filler cap with a pre-loaded valve, which holds the pressure to 7 lb. per sq. in. This is said to improve low-speed operation at high temperatures, and to provide added heat to the hot-water heaters. A composition resin-impregnated fabric washer replaces the former carbon seal in the water pump.

The carburetor has a new bowl, and the accelerating pump linkage is arranged to speed up the travel of the pump plunger through the first part of the movement. On the 40 and 50 carburetors, the metering pins have been removed, as had been done already on the larger engines. The anti-syphoning device now is a part of the accelerator pump. An inverted type of fuel pump is now used on the larger engine, and is available as an accessory on the smaller one.

The fuel line is arranged to damp out all sound or vibration from the fuel pump by introducing a flexible hose section consisting of Neoprene wound with piano wire, covered with canvas.

The automatic-choke stove has been completely redesigned. It now incorporates a tube of Inconel fitted in the exhaust-manifold-valve inlet. It heats rapidly, reducing the warm-up period considerably. Another new device added to the choke is a "blocking cam" which automatically positions the accelerator pedal for starting. This prevents the choke "deloader" from operating until the engine has started. Moreover, the "deloader" can be made to function only by depressing the pedal past the blocking-cam spring.

Mufflers are now made of leadcoated steel, to increase their life. As before, the entire exhaust line is insulated from the running gear by the use of heavy rubber-impregnated fabric secured in brackets. On Series 40, 50, 60, and 70 the exhaust pipes are made in two pieces, to facilitate disassembly.

Full-length engine side pans are provided, and are fastened to the frame only. On the Series 50 and 70 an outer side pan is fitted on the left side of the pedals to prevent entry of dirt and water.

Engine mountings have been redesigned, and now contain a greater volume of rubber. At the rear, the

(Turn to page 402, please)

Advances to 1940



The Buick Series 50 super four-door sedan, one of the new lines added for 1940.

NEW CARS

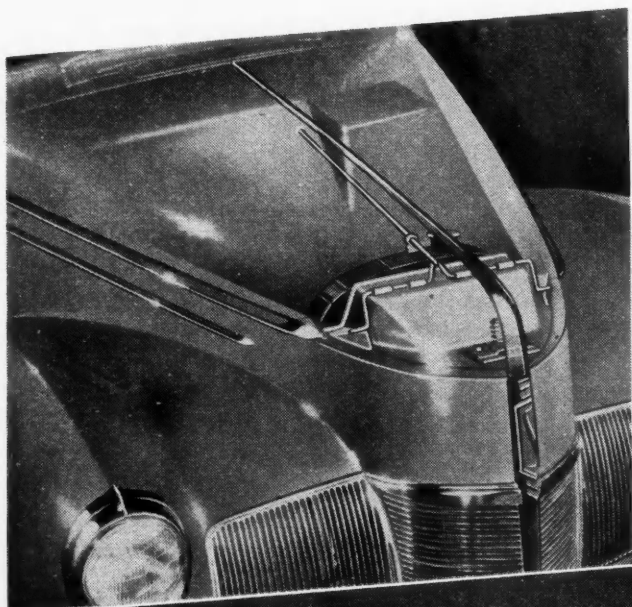
Studebaker 1940

STUDEBAKER enters the 1940 season with its three lines of cars—the Champion, Commander, and President—comparatively unchanged in styling and mechanical units. While the bodies and front-end sheet metal remain unchanged, much has been done by way of detail improvements to increase eye appeal. Interior treatment and instrument panels on the Commander and President are entirely new.

Wheelbases remain unchanged on all models. On the Commander and President the rear tread has been increased 1½ in., to 61 in., to permit of wider rear seats.

Engines remain unchanged. That of the Champion

Below is shown the Studebaker Champion four door sedan while at the left is the hood-locking mechanism that is operated from under the instrument panel.



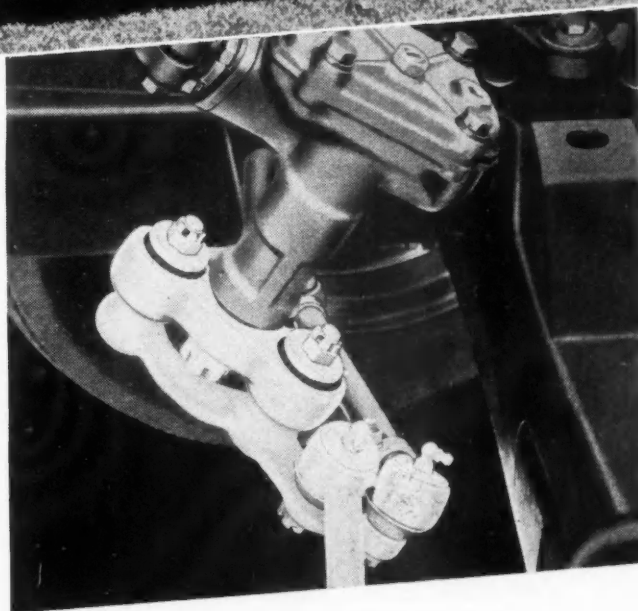
Models



The Studebaker Commander coupe has 26.5 cu. ft. for luggage. At the right is the steering hookup. Rubber bushings are used to absorb road shocks.

is a six-cylinder of 3-in. bore by $3\frac{7}{8}$ -in. stroke. (164-cu. in. displacement) rated 78 hp. at 4000 r.p.m. The Commander engine is a six-cylinder of $3\frac{5}{16}$ -in. bore by $4\frac{3}{8}$ -in. stroke (226-cu. in. displacement) rated 90 hp. at 3400 r.p.m. The President has an eight-cylinder engine of $3\frac{1}{16}$ -in. bore by $4\frac{1}{4}$ -in. stroke (250-cu. in. displacement) rated 110 hp. at 3600 r.p.m. The compression ratio is 6.5 on the Champion and 6.0 on the Commander and President, all of which have cast-iron heads. During the early part of the past season a change was made in the piston-ring equipment of the Commander, two $\frac{3}{32}$ -in. rings being substituted for the $\frac{1}{8}$ -in. ring originally used. This ring equipment is continued for 1940.

As regards front-end styling, the die-cast radiator grilles have about the same form as last year, but on the President and Commander they have a square cross-hatch pattern instead of the vertical bars of last year's design. On these same two models the windshield openings have been made higher to provide better visibility. The new type of safety glass, used during the last five months of the previous season, will be continued. There are concealed hinges on all doors.



The alligator hoods now are latched from the interior.

Sealed-beam headlamps are standard on all models. These are mounted on the fenders and the parking lights are located in the lower part of the headlamp.

An overdrive unit is offered as optional equipment on all models. The "Planar" independent front suspension with cross spring is standard throughout. All generators have higher capacity and all have current-voltage regulation. The under-seat heater, first used

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Chryslers are

NEW styling, with entirely new sheet metal and bodies, coupled with a weight distribution similar to that which obtained in the Airflow, are features of the 1940 Chrysler line. Six models are offered for the coming season: The Royal with six body types, the Traveller with four, the Windsor with seven, the New Yorker with five, the Saratoga with one (a six-passenger sport formal sedan), and the Crown Imperial with three.

The rear axle on all models has been shifted $7\frac{1}{2}$ in. to the rear, while the front axle has been moved back 4 in. Wheelbases of the various models have been increased correspondingly, as follows: Royal and Windsor, $3\frac{1}{2}$ in., to $122\frac{1}{2}$ in. ($139\frac{1}{2}$ in. for seven-passenger models); Traveller, New Yorker, and Saratoga, $3\frac{1}{2}$ in., to $128\frac{1}{2}$ in.; Crown Imperial, $1\frac{1}{2}$ in., to $145\frac{1}{2}$ in.

These changes have made possible the development of a body construction in which the rear doors are without the usual cut-out for the wheelhouse. Sealed-beam headlamps are standard equipment. In the Royal and Windsor models the parking lights are in the top of the headlamps, while on all other models there are individual parking lamps mounted on top of the front fenders. Two-speed electric windshield wipers, with automatic circuit breaker, are standard on all models.

An automatic overdrive unit which can be put in direct by the driver at any time is available on the Windsor, New Yorker, Saratoga and Crown Imperial.

Hydraulic couplings are available on the three last-named models when equipped with an over-drive unit. This latter combination is standard on the Crown Imperial.

The new models are furnished with or without running boards. High-test safety glass is standard on all bodies. A large rear window, curved in sedans, plane in coupes, of heat-tempered glass, is used in all bodies. Floors and roof tops are lower. Front doors are fitted with concealed hinges. Hancock rotary door latches are found in all doors.

Powerplant specifications are as follows: Royal and Windsor, six-cylinder L-head engine of $3\frac{3}{8}$ -in. bore by $4\frac{1}{2}$ -in. stroke (242-cu. in. displacement), rated 108 hp. at 3600 r.p.m., with cast-iron heads and 6.5 compression ratio. The rating has been raised 8 hp. over last year, which is due to the use of a new high-lift camshaft.

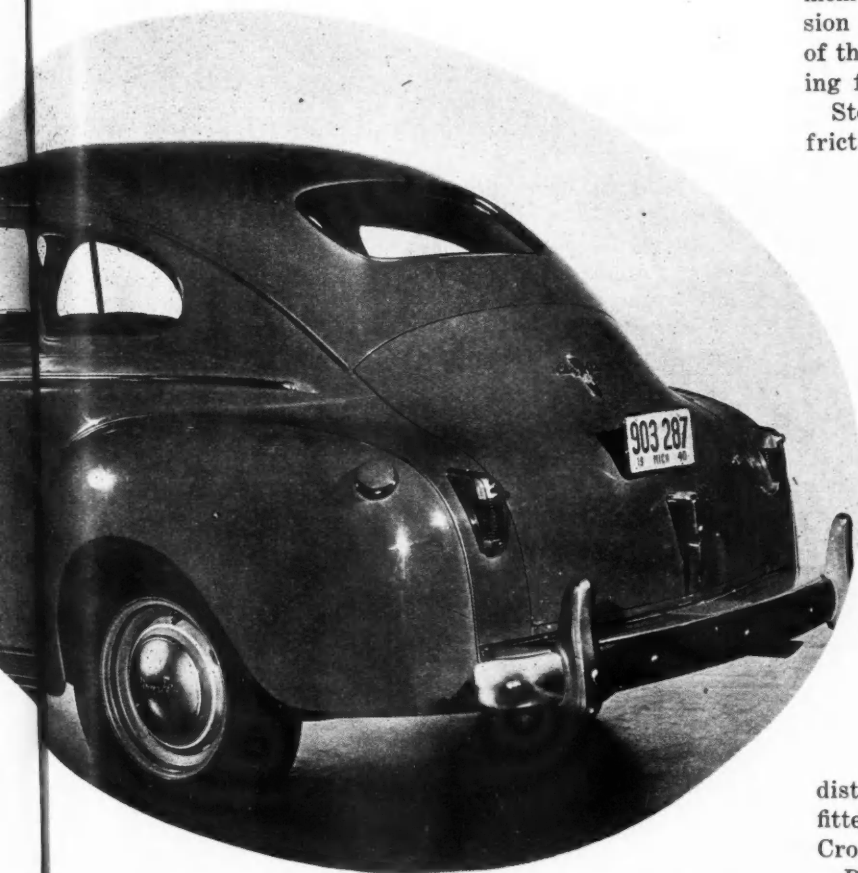
Traveler, Saratoga and New Yorker models all use the same engine, an eight-cylinder L-head of $3\frac{1}{4}$ -in bore

The Chrysler Royal 6-passenger sedan has a wheelbase of $122\frac{1}{2}$ inches and 108 horsepower.



Redesigned

by 4 $\frac{7}{8}$ -in. stroke (324-cu. in. displacement), rated 135 hp. at 3400 r.p.m., with cast-iron head and 6.8 compression ratio. A special aluminum head with a 7.45 compression ratio enables this engine to develop



Rear view of the 6-passenger sedan has been redesigned. The rear window is made of curved plate glass without divider strip.

143 hp. The Crown Imperial power plant is the same as that just described, except that an aluminum cylinder head with 6.8 compression ratio is standard and the rating is 137 hp. This engine develops 143 hp. with a special aluminum cylinder head and a compression ratio of 7.45.

Owing to the adoption of sealed-beam headlamps, the generator capacity has been increased to 35 amps. Generators have full voltage-current regulation. A new edge-type fuel filter is mounted directly at the carburetor.

Transmissions have the shift levers projecting from the side. There is no exposed control tube. The new column-mounted shift lever is a plastic molding with steel insert, whose color harmonizes with that of the

interior trim. Shifting is facilitated by new synchronizers and better chamfering of the teeth of the low-speed and reverse gears. These gears now have wider faces, for greater strength.

Frames are new and lower, with large front cross members and a sturdy X member. The front suspension has been improved by changing the angularity of the control arms and providing a more rigid mounting for the upper arms.

Steering has been improved by liberal use of anti-friction bearings in the steering gear, and by the use of roller bearings and ball thrust bearings on king pins. Connection by an individual tie-rod to each wheel is employed on all models. There is rubber insulation between the frame and steering housing on the Royal and Windsor models, as in 1939 models.

The hypoid rear axle on the Crown Imperial is new, and incorporates a barrel-type differential case, which permits the use of large-diameter differential gears. The weight of the new axle is less than that of the former models.

A seal has been added in the rear axles of all models to prevent grease from getting onto the brake linings. Cross-type roller-bearing universal joints, with four sets of rollers in each joint, are fitted on all models. The distribution of braking effort between the front and rear has been changed in accordance with the new weight distribution. Two-cylinder-type hydraulic brakes are fitted on the Traveler, New Yorker, Saratoga, and Crown Imperial.

Rear door windows in four-door sedans lower completely. Rear-quarter windows in sedans have greater glass area, to provide better vision for rear-seat passengers. The luggage-locker lid in sedans is larger, and the sides and bottom of the opening are flush with the floor, just above bumper height, making it easy to load or unload luggage. The license plate light, luggage-locker-lid handle and lock are combined in a unit.

The tail lamps, mounted in the body panels at the sides of the luggage opening, extend through to the inside of the luggage locker and provide light for the compartment when they are on. The spare wheel and tire, mounted vertically at the right side of the luggage locker, can be easily removed. Another advantage of this location is that the tire pressure can be checked without difficulty. A gravel deflector between the rear bumper and body prevents marring of rear panels by flying stones. It is not attached to the body and is

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Die Casting . . .

APPPLICATION of die castings in 1940 models of passenger cars and trucks parallels in a degree that for 1939 and earlier models, but is on a still more extensive scale. There is also a group of new uses both for parts which are strictly mechanical or structural and for those which perform also decorative functions and are important items in new styling. Zinc alloys, produced in accordance with SAE standards, again account for the usual predominance in tonnage, estimated as in excess of 95 per cent of the total, but there are some additions to the list of parts made in aluminum alloys and one car manufacturer is expected to continue the use of three magnesium die cast parts initiated (as reported in these columns) about the middle of this year.

Especially noteworthy is the extended use of die cast parts on cars selling in the lowest price brackets. Four out of six of these makes (not including the diminutive cars) are scheduled to have die cast radiator and/or fender grilles, not to mention several other die cast parts, and since these cars are in large production, the total increase in zinc alloy tonnage

will be large. There is a somewhat similar extension of use in the next higher price brackets, also including several makes in large production, and with Packard now using die cast fender grilles, the medium to high price groups have few representatives in which die castings are not dominant features of the front end.

Packard continues its successful use of a die cast cover for the gearset and numerous die castings on several makes are added in parts for gear shifting systems. In the diminutive car class, Crosley steps forward with the entire housing for the gearset die cast.

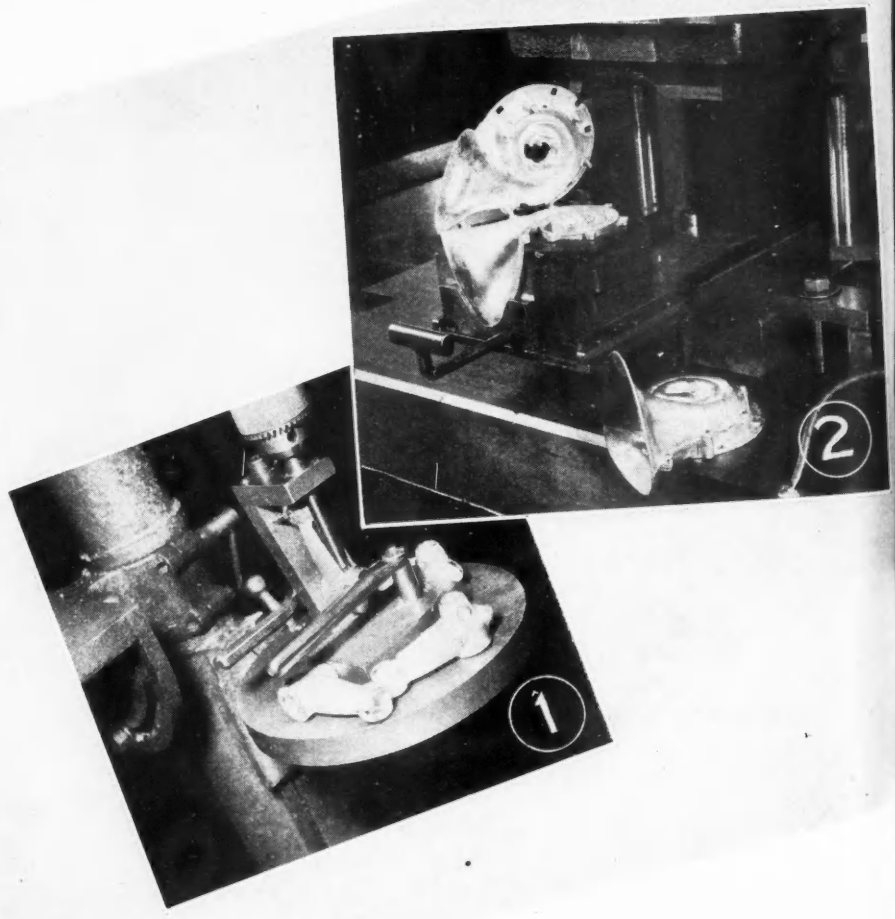
Trends in other directions may be summarized as follows:

1—On instrument panels, there is a much extended use of die cast radio grilles, instrument frames, glove doors, ash tray doors, moldings and other bright trim.

1. Setup in which an end mill is used in a drill press to remove a fin left between a cored slot and a cored hole in the piece shown, which is a part of the gear shifting mechanism used on cars in the Hudson line. The fixture includes a guide bushing for the mill and a pivoted bar which holds the casting in place. Some 350 pieces per hour are handled in this fixture in the plant of the Michigan Die Casting Company.

2. (Two photos). Delco horns are assembled in this fixture setup in a punch press. Thirteen integral rivets, cast on the upper half of the horn pass through mating holes cored in the lower half. When in place and the die is slid under the ram of the press, the rivets are struck and clinched simultaneously, making a secure and permanent fastening. Before assembly, mating faces of the walls forming the spiral passages are wet with a heavy paint or cement to insure a tight seal.

3. (See facing page). In this die cast aluminum alloy direction signal control housing for the new Buicks, central and side holes having parallel axes are reamed in a two-spindle drill press. A toggle clamp holds the casting in a sliding fixture which is located at right and left by suitable stops. Recesses in the under side of the casting insure correct angular location. Reamers have pilot extensions which fit fixture holes and insure true hole reaming and accurate center distances. An ejector ring facilitates removal of the piece. Two holes are reamed in 200 castings an hour, in Doehler's Toledo plant.

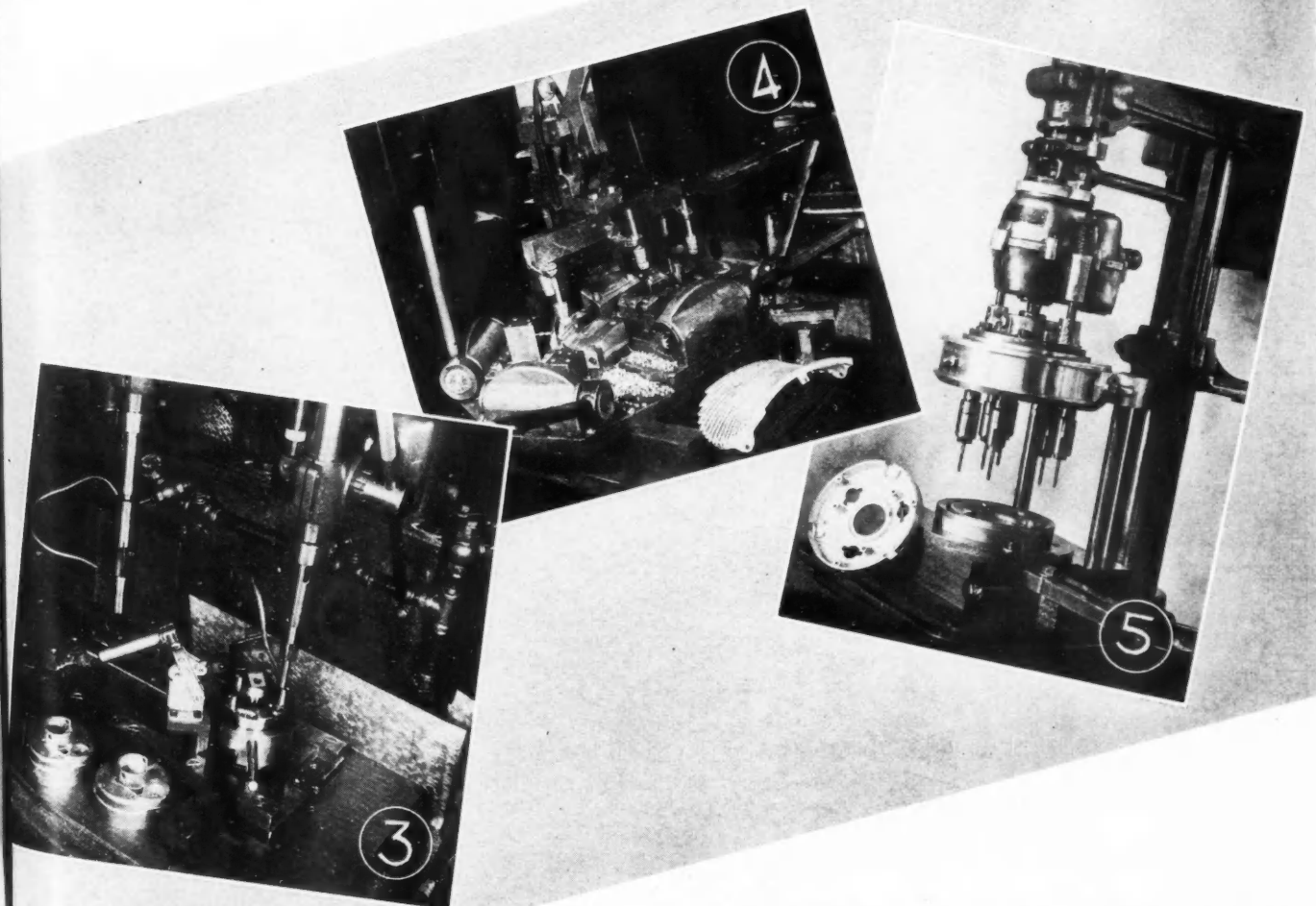


**is being generously used
in the fabrication of parts
in 1940 cars from the low
price bracket to the top**

2—In lighting, the use of die cast bezels for headlamps is further extended and there are several new die castings in rear license lamps, and tail lamps. Some of the sealed headlamp units use a sealing ring or bezel die cast in an extremely thin section and containing integral lugs and others have a stamped ring with die cast lugs attached to it.

3—There is a return to die castings in horns (of which several million probably will be produced) and one new design includes integral rivets which are headed over to fasten the two halves together, doing away with screw fastenings.

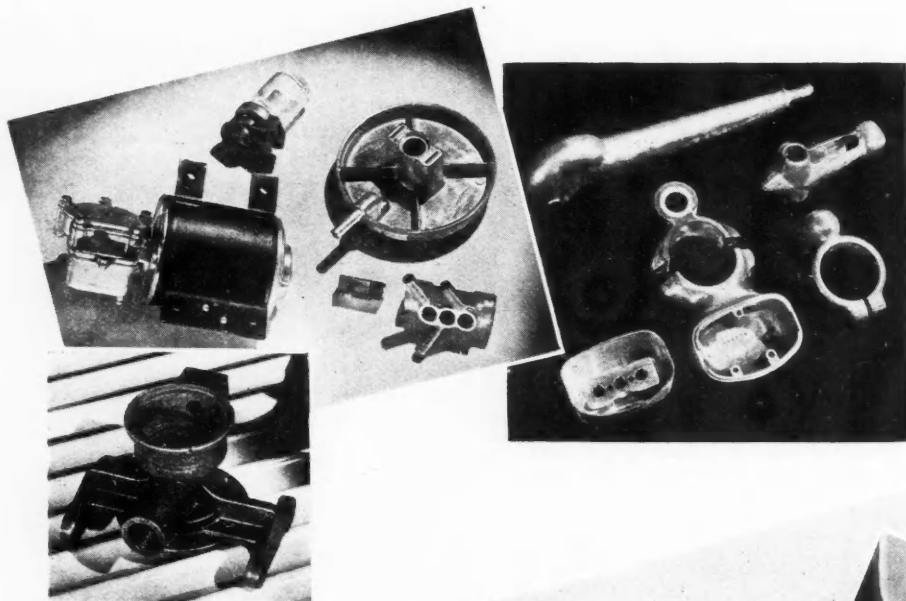
4—Continued use of die castings not only for steering wheel hubs, but for separate covers for the hub, and in some cases for housings which support the under-wheel shifting mechanisms. Some of the shifting levers are die cast with a channel section and certain interior parts are similarly cast. In addition, even more horn rings are being die cast, and some cars have parts of the direction signal controls die cast also, so that a large part of the assembly at the top of the steering column is built up from die castings. (Next page, please)



4. This fixture is used to punch the four holes required in supporting ears, 0.070 in. thick, of the new fender grille for Packard cars. A slide with three rubber feet operated by a toggle lever clamps the piece in position. Punches are then advanced by racks operated by hand by swinging the four levers on pinion shafts. This operation, which makes it unnecessary to core small holes at odd angles, is performed in Doehler's Toledo plant at the rate of 200 pieces an hour.

5. Horn ring covers in zinc alloy, used on the new Buicks and produced by the Schultz Die Casting Company, have six holes tapped simultaneously in this drill press setup, which includes an Ettco tapping head. The casting is held in a simple circular fixture having lugs to insure correct angular location.

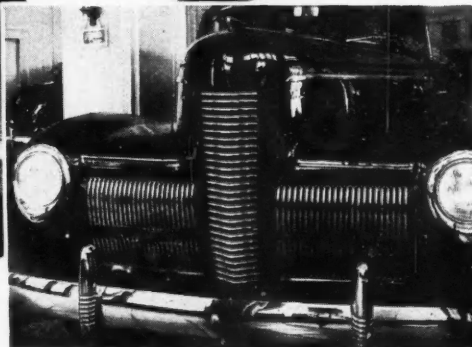
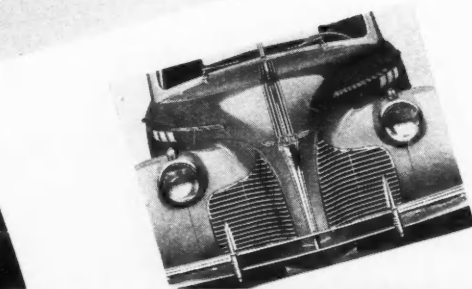
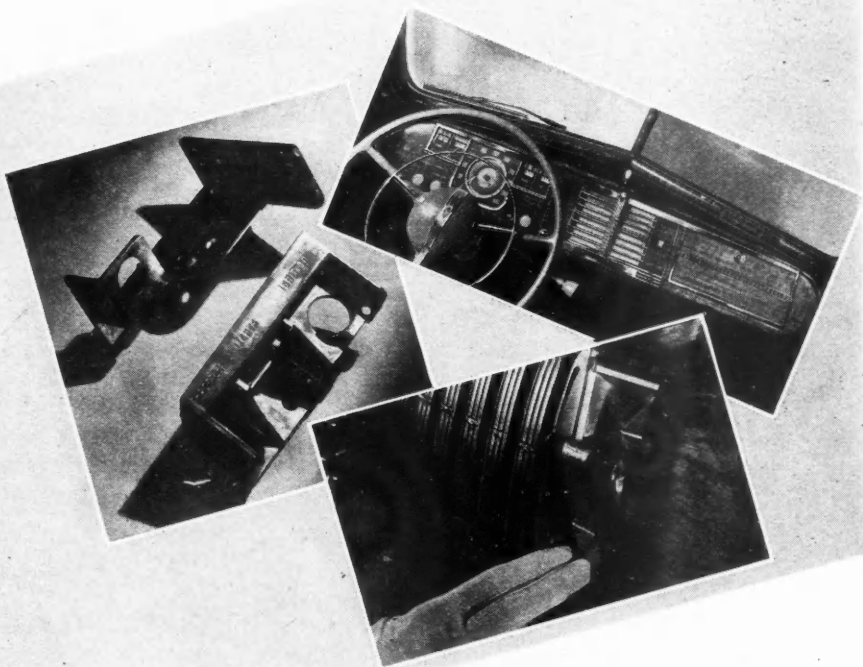
MATERIALS



These mechanical parts are among the newer ones die cast in zinc alloy. They include the Nash shifter lever and part of the Hudson shifter lever, other parts of the Hudson shifter assembly, Hudson direction control signal parts, a Dodge fuel filter part, two end castings on the Auto Lite electric windshield wiper, three castings for vacuum operating mechanism for convertible tops and a new Stewart-Warner electric fuel pump body for General Motors Trucks.

Instrument panels include numerous zinc alloy die castings. Here shown are the complete Plymouth panel and part of the DeSoto panel. Of these, the first has die cast glove doors, radio grilles and instrument frames, also die cast ash receiver cover and horn ring. DeSoto's ash receiver, radio grille and glove door are die cast. Die casters represented include:

Schultz, Continental and Alemite.



Front ends of Nash, Hudson and Pontiac cars showing the new grilles which are die cast in zinc alloy and plated. The Pontiac grille is cast in two sections, Nash in three sections and Hudson in fourteen sections. Studebaker Champions are of four sections while the Willys is of two parts. Beside grilles, the die cast parts include hood center molding and side ornament and windshield center molding on Hudson and headlamp bezels on Nash and Hudson. Die casters represented include: Doehler, Precision, Schultz, Ternstedt, Alemite, Paragon and Hall Lamp Company.

5—Extended applications of die castings to such mechanical parts as electric and vacuum windshield wipers, fuel pumps and filters, oil pumps and oil seal rings, convertible top operating mechanisms and roller seat adjusting mechanisms.

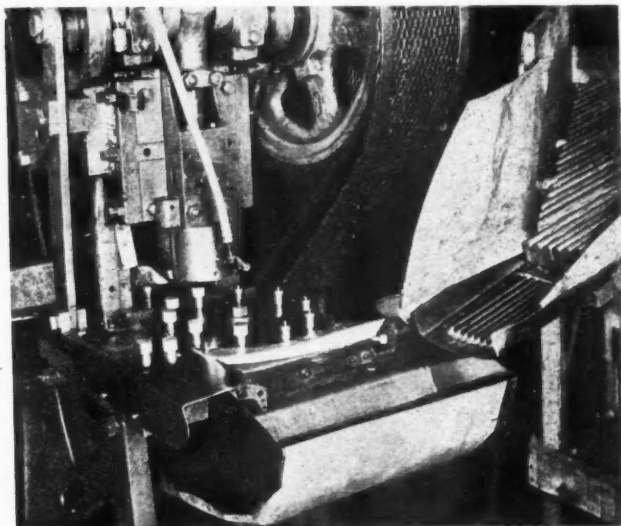
6—Wider use of die castings in body parts, including door latch parts, garnish molding inserts, special fittings for convertible bodies, exterior belt moldings, hood moldings and hood louver parts.

7—Further use of die castings, including some of remarkably thin sections, for heater housings, air inlet fittings and defroster parts.

8—Extensive application of die castings to hood noses or prows, more or less to take the place of what was once called the radiator "ornament." Often this involves two or more castings which sometimes include hood locking parts.

This by no means exhausts the list, but it does give some idea of the extent to which die casting is being relied upon for fabricating parts with remarkable economy and with surfaces so smooth that finishing is greatly simplified and its cost reduced. Many of the parts are quite complex and of such shape that they cannot be made by other means and still realize an economy approaching that of the die casting. Such parts as interior and exterior hardware continue to be die cast and plated much as heretofore, but with

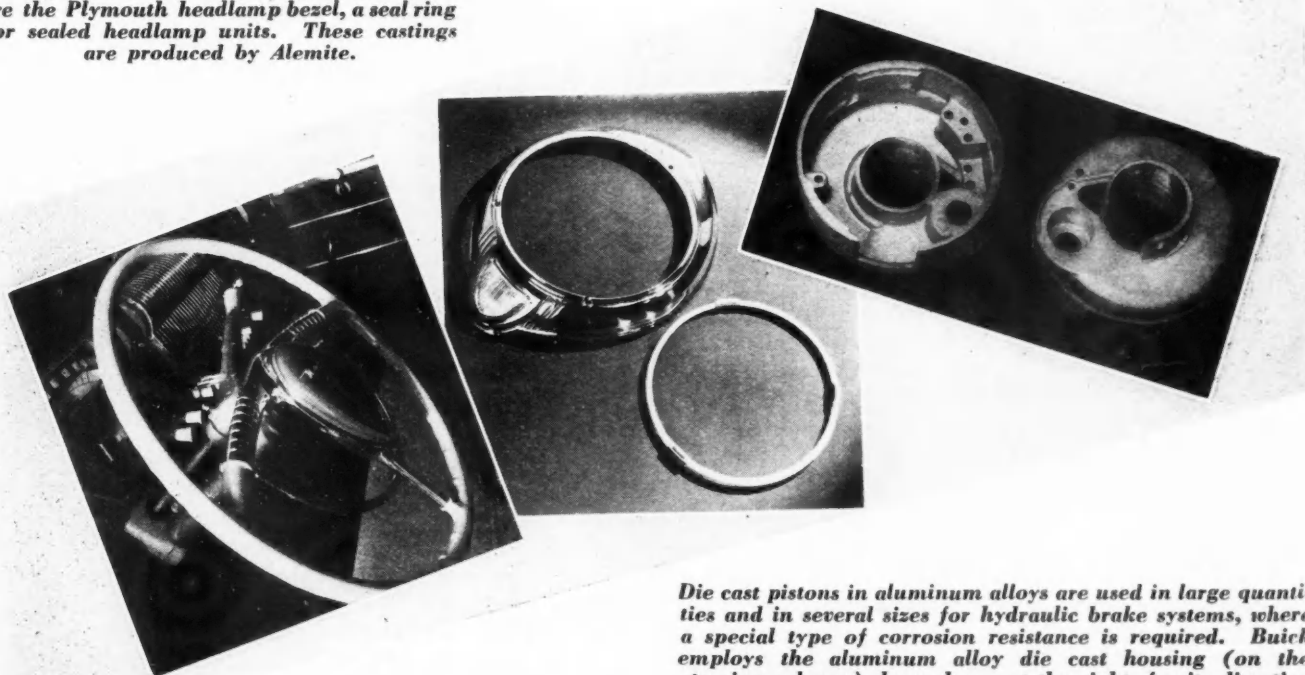
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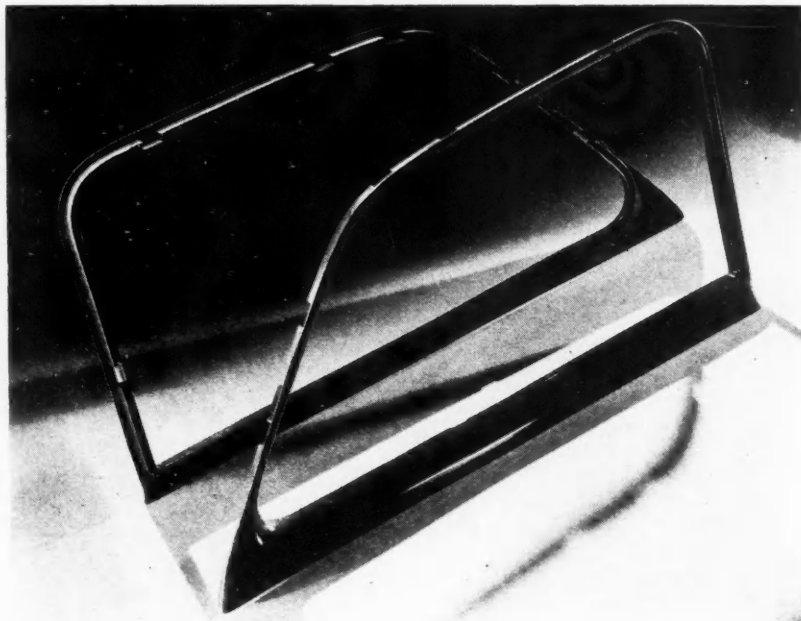
(Above) In the same plant (Doehler) the outside diameter of 2700 hydraulic pistons an hour is accurately sized in this punch press setup. Pistons are carried under the ram on a dial arranged for positive intermittent motion with a pause each time a piston comes below the burnishing tool mounted in the ram. Descent of the ram forces the piston through the hole in the center of the tool which is sized slightly smaller than the piston. This removes the draft required on the casting and leaves a smooth and true cylindrical surface which is held within plus or minus 0.0005 in. of nominal size. On the up stroke of the ram, a timed blast of air ejects the piston through a hole in the back of the tool holder and into a chute. All the operator need do is to load the dial. As no metal is removed, there are no chips and pistons are discharged ready for centerless grinding.

Extended use of die cast parts in zinc alloy is found on several cars in assemblies at upper end of steering columns. The Hudson assembly includes the wheel hub, inner part of shifter lever and the housing and bracket for direction signal control. On Nash cars the assembly shown at the left includes the wheel hub, horn ring and shifter lever. Die casters represented include Stewart and Paragon.

In the center are several new zinc alloy die castings used in lighting equipment. Shown are the Plymouth headlamp bezel, a seal ring for sealed headlamp units. These castings are produced by Alemite.



Die cast pistons in aluminum alloys are used in large quantities and in several sizes for hydraulic brake systems, where a special type of corrosion resistance is required. Buick employs the aluminum alloy die cast housing (on the steering column), here shown at the right, for its direction signal. End bells are also die cast in magnesium alloy for use on Ford Lighting generators and starting motors. (Photo courtesy Doehler Die casting Co., which produces all of these.



One-piece garnish moldings of cellulose acetate are now being injection molded in this country. Parts such as these have been used for some time in European cars. The moldings shown to the left have a projected area of 95.26 sq. in. and are molded in integral colors requiring no finishing or coating. They are being produced by Thermo-Plastics, Inc. of material supplied by the Tennessee Eastman Corp.

P LASTICS

D By MICHAEL A. BROWN, JR.
 DEVELOPMENTS in the manufacture, fabrication and application of plastic materials during the course of the past three years have considerable significance for those engaged in the designing and producing of automotive equipment. The plastics industry has been going through a period of steady growth coupled with remarkable changes in the products and manufacturing techniques of the industry. Stimulated by intelligent and well-planned research in laboratories widely diverse in aims and geographical location, a number of new materials with new properties and increased usefulness have been introduced. The automotive industries have been alert to the possibilities of these new materials, while at the same time giving continued attention to the application of the older plastics in automobiles. Along with these developments have been improvements in the methods of fabricating plastics into finished parts and wider adoption of more economical and efficient fabricating processes.

One of the most interesting of the newer plastics is the acrylic resin type. It has a clear glass-like appearance, superior to ordinary flint glass in light transmission. Its most unusual property is that of internal reflection of light, which means it can carry light as in a tube and bend it around corners. A rod of this material lighted at one end will glow only at the other end, even though it be bent out of sight. This feature has been much publicized in connection with surgical probes and tongue depressors made of materials of this type.

Since they are thermoplastic (will soften with heating and harden under chilling), they are available as molding powders for use either in compression or injection molding. They may be molded with standard equipment under normal pressures. While in the molded form natural transparency is retained, the high clarity that marks the cast forms does not appear without buffing or polishing.

In the cast form, they are available in standardized sheets, rods, tubes and blocks which are readily machinable. In many cases, however, it is more economical to form parts of acrylic material by heat forming. In this process, the blank is softened by immersion in hot water or steam for a short period and then formed over forms of wood or other material.

Despite a cost per pound somewhat higher than older thermoplastic materials, they have already been adopted for several automotive applications. Instrument panel faces have been made of the material in which the sheet is etched on the front surface with calibrations. The panel is then lighted from a concealed source and the surface glows at the etchings.

Another interesting development is the transparent molded phenolic, recently made commercially available. Like the familiar phenol-formaldehyde molding compounds, this new material is thermosetting (setting under heat and pressure into an infusible, non-flammable form). It is produced in transparent colors that compare with ruby glass in light transmission, making it useful for stop-signals, rear lamps and

similar applications.* Such parts may be compression molded.

Polystyrene, a plastic with excellent acid and alkali resistance and electrical insulating properties especially under very high frequencies, has been made commercially available. Like the two previously mentioned materials, it is naturally transparent, but lacks good clarity.

The introduction of cellulose aceto-butyrate and ethyl-cellulose have expanded the scope of the cellulose plastics. The first has higher flexural and impact strength than straight acetate and it is reported that several of the new models will have steering wheels molded from this material.

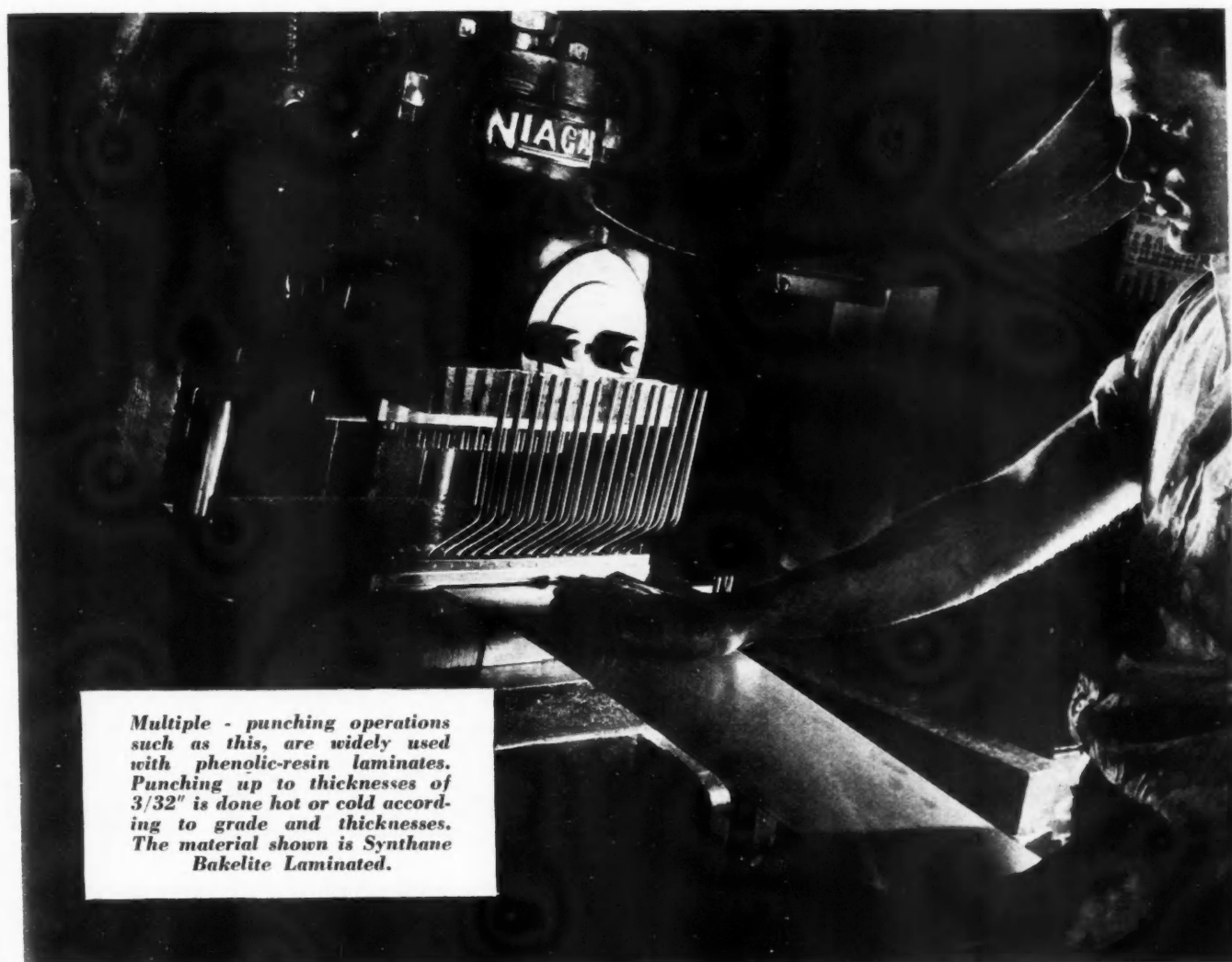
Concurrent with the development of better and more

* A table of properties of the newer plastics is reproduced on page 406.

versatile molding compounds has been the improvement in molding processes, particularly in injection molding. The advantages of this method, whereby the molding material is brought to a flowing state in a heating chamber and injected from there into a mold held at a lower temperature, has offered many promising possibilities. The automaticity, lower operating cost and better handling of inserts has stimulated a remarkable increase in the number of injection machines in operation today. At the same time the size of the machines in production have been increased several-fold. While as recently as two years ago a good-sized machine could inject 8-oz. at a shot, today several 32-oz. machines are in commercial operation.

Since injection-molding first demonstrated its practicability with thermoplastic materials, attempts have

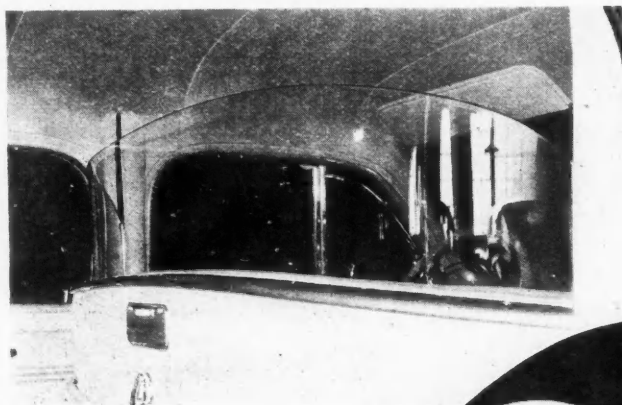
On 1940 Cars



Multiple - punching operations such as this, are widely used with phenolic-resin laminates. Punching up to thicknesses of 3/32" is done hot or cold according to grade and thicknesses. The material shown is Synthane Bakelite Laminated.

MATERIALS

A light curved sheet of Plexiglas, a cast acrylic material made by Röhm and Haas Co., Inc., is used in this custom-built limousine. Light weight, transparency and workability of this material make it adaptable to such applications.



This Chevrolet gear-shift knob is made up of three parts, the cone-shaped shell and the cap injection-molded of Tenite, and a rubber core. In assembly, the rubber core is slipped into the shell; the cap, edged with cement, is snapped down over it and the unit is forced onto the shaft. An under-sized hole in the core assures a tight friction fit.



been made to adapt it to thermosetting materials, a problem complicated by the fact that heat-setting plastics when held under heat for any length of time would jam the conventional injection mold. Attempts to overcome this have looked to providing a means of completely scouring the heating chamber and the mold after each charge or to providing automatic means of measuring, loading and molding the piece.

Plastics in the Automotive Body

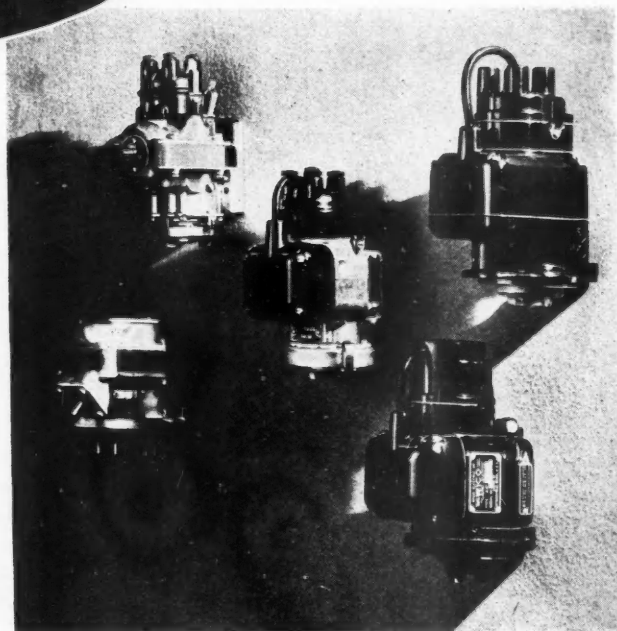
Probably the most important advances in the application of plastics in the automotive industries have come in the automobile body where they have been able to assist in providing more luxurious fittings, more pleasing appearance and greater comfort, without increasing costs. They are used to these ends in the 1940 cars more than ever before. Laminated plastics, in particular, are receiving greater attention. Their inherent strength and insulating properties coupled with a new improvement in the laminating process further increase their usefulness.

Until recently, this process, in which sheets of resin-impregnated fabric or paper are pressed under heat into infusible, dense materials, has been confined with exceptions, to the production of flat sections. Recent developments enable the impregnated sheets to be formed into three-dimensional sections with considerable depth, opening a new field for heat-setting laminates in automobiles.

A number of advantages both in production and in use are thus possible. The surface of such a part is hard, long-wearing and dimensionally stable. It has a pleasant feel and will not become untouchable in summer heat, nor freezing cold in winter. The piece itself is light and strong, with little danger of warping. If the natural color of the laminate is used, wear will not cause discoloration, while the surface will readily take usual coatings. Surface decorations or embellishments can be easily worked into the design at the laminating stage.

In models of the past year, Ford has used a number of glove-compartment doors made in this way. Of greater importance is the reported adoption of laminated baggage-compartment doors, the largest pieces yet to be made by molding-laminating, for one of the cars made by the same manufacturer. Lugs and projections for the installation of hardware are incorporated into the piece, which has been subjected to a number of service and field tests without damage.

Of interest in connection with laminates in car



Over a period of time Wico magnetos show a progressive increase in the number of molded plastic parts used in the assemblies. Originally adopted for their electrical properties, these parts now are used to provide lighter weight, cleaner design, corrosion resistance and better appearance. Molded by Plastics Division, General Electric Co.

bodies, are developments in the fabrication of airplane fuselages of plastic materials. Experimental air-
(Turn to page 404, please)

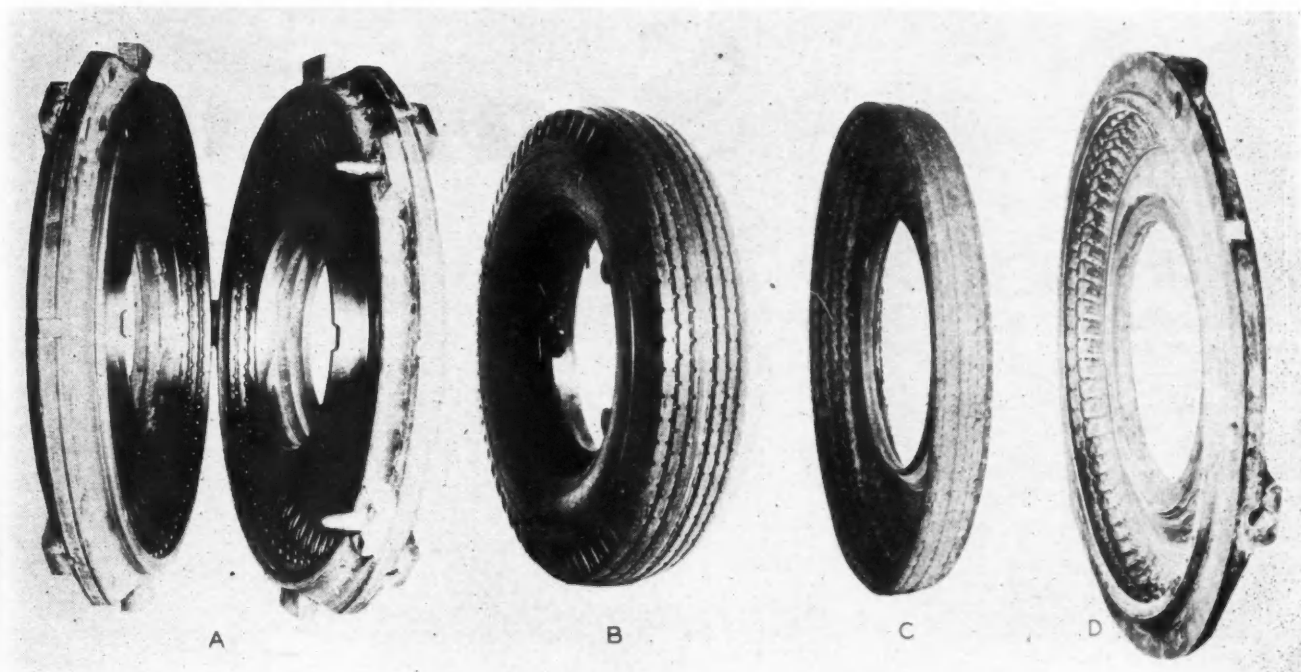


Fig. 1—Showing the evolution of an electroformed pattern from the cavity of a conventional tire mold (A)

Molds and Dies by Electro-Deposition

A PROCESS of forming by electro-deposition, metal molds for curing tires or for molding articles from plastic materials, etc., has been developed by the United States Rubber Company, and is known as the Ekko process. It was originally intended for making tire molds, to reduce the cost from that of the conventional die-sinking process, but it was soon recognized that it has many other possible applications, and during the early part of the current year a special department was established in the U. S. Rubber plant in Detroit to make Ekko products available to industry generally. We understand that aside from its use in making molds for curing rubber tires, the Ekko process of "electroforming" already has found applications in the plastics, glass, embossing and metal-stamping industries.

The process consists essentially in depositing iron or some other metal from an electrolytic bath on a pattern, to a thickness of up to $\frac{1}{2}$ in. When the deposited shell is separated from the pattern, it forms a cavity, and after the shell has been properly mounted, it can be used to mold or stamp objects of exactly the same shape as the original pattern.

A pattern of the article to be made or cured is rendered conducting by applying a coating of powdered graphite, and a thick layer of metal is deposited on this coating electrolytically.

Fig. 1 shows at A a tire mold made by the usual process, the tread design and cavity being cut in a steel forging with special engraving machines. The forging is later mounted in a cast-iron back called a "watch case." After a mold like that shown in Fig. 1 has been produced by engraving, it can be reproduced any number of times by

(Turn to page 418, please)

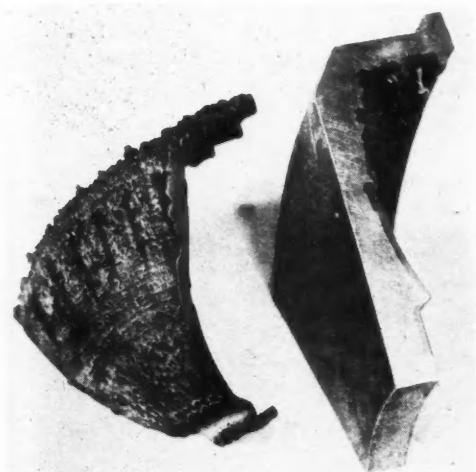


Fig. 2—Electroformed pattern or matrix obtained from an engraved mold. The roughness on the outside of the shell is characteristic of heavy electro-deposits. The backs of such shells are machined to the desired form

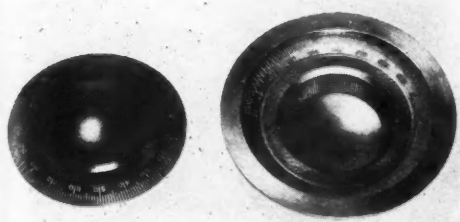


Fig. 3—The Bakelite radio dial shown at the left served as the pattern for electroforming the "cavity" shown at the right



Fig. 4—The engraved plunger at the right produced the rubber negative in the center. From this the duplicate at the left was electroformed

Stainless

MORE and more applications of the types of alloyed metals known as stainless steels are steadily being made by the automotive industry. Some automotive applications of bars and wire are given by the Rustless Iron & Steel Co. as follows:

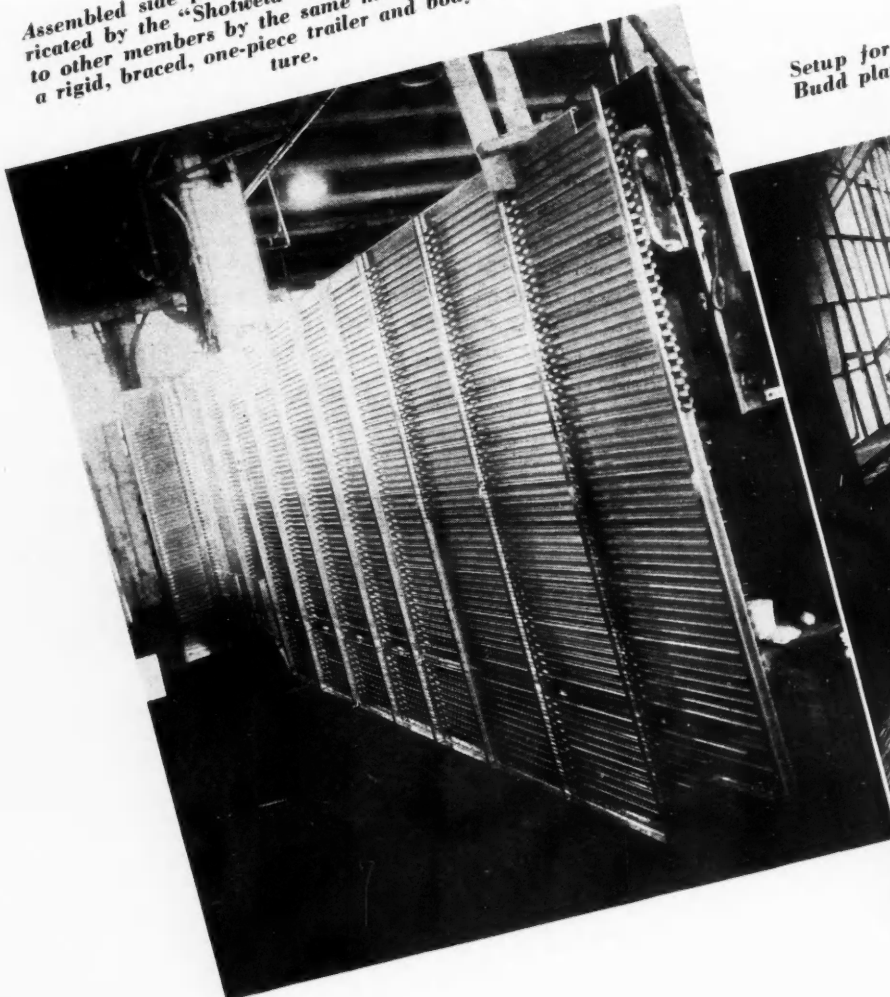
Application	Grade Used	Type No.	Reasons for Use
Steering-wheel spokes	18-8	302	Non - rusting and
	12-2	414	high elastic limit
Miscellaneous screws.	17 Chrome	430	Non - rusting and
			easily cold-headed
Water-pump shafts...	12 Chrome	416	Strength and cor-
	Machining		rosion resistance
Body trim	17 Chrome	430	Resistance to at-
	18-8	302	mospheric corro-
			sion
Heat-control	17 Chrome	430	Resistance to cor-
valve shafts			rosion and scal-
			ing

Stainless steel strip is in extensive use as moulding

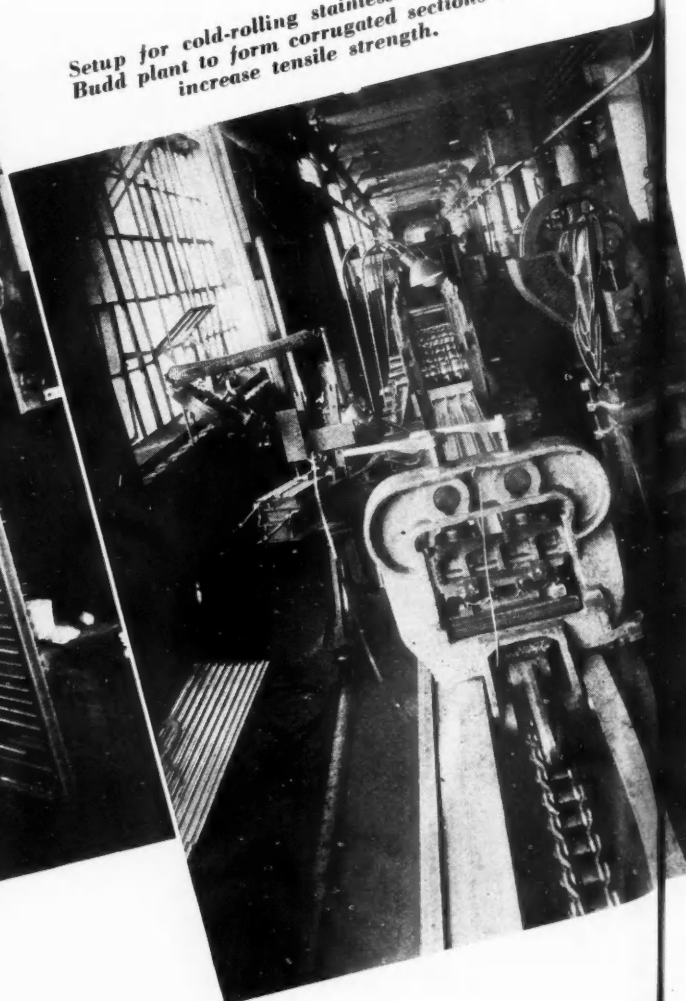
on passenger automobiles. For instance, on Studebaker Commander and President models it is employed for the hood top-center moulding and hood panel moulding, body cowl belt, front- and rear-door belt, rear-quarter belt, outer moulding of windshield center bar, and finish moulding of instrument-panel opening. Headlamp lens-retaining rings and door-trim finishing plates and compartment door panel finishing plate also are of stainless steel. Much the same trim is used on Champion models, plus inner and outer glove-box door moulding on the instrument panel, door-lock outer handle assembly and sill-panel moulding assembly.

Corrosion and heat-resistant steels are used in Packard cars for engine exhaust valves and heat-control valves in the exhaust manifold. Low-carbon, 18 per cent chromium sheets are employed for certain deco-

Assembled side panel of Budd semi-trailer, fabricated by the "Shotweld" process. It is welded to other members by the same method, forming a rigid, braced, one-piece trailer and body structure.



Setup for cold-rolling stainless strip in the Budd plant to form corrugated sections and increase tensile strength.



Steel...

is constantly finding more and more places in the modern automobile in structural and embellishment members

rative mouldings, and mild steel chromium plated for others, the choice depending upon cost considerations peculiar to the particular parts.

Limited applications of stainless on International trucks is on the radiator grill and as details of trim.

Some passenger-car hub caps, window pillar trim and rear-view mirror backs are made of the metal.

Stainless steels of 14 and 18 per cent chromium and 8 per cent nickel are used by the a.c.f. Motors Co. in its motorcoaches for window sash, interior trim, stanchions, seat frames and parcel racks. In its parlor coaches sold to the Southeastern Greyhound Lines for express service, the sandwich buffet and the water cooler also are of these metals.

All metal work in the kitchen and bathroom of the Fleetwheels-Coates special house trailers built for the Gatti African expedition last year was of stainless steel.

Steel companies and automotive companies are co-operating in investigations and experimental work with respect to uses of the steels for engine valves, springs and other mechanical parts, but the developments have not reached the stage at which new processing technique can be made available for publication.

Integral semi-trailer and body of 18-8 stainless steel built by Edward G. Budd Mfg. Co. No painting is needed and users prefer leaving metal in its natural state because of its attractive appearance and advertising value.



Automotive Industries

Sole use of stainless steel as a structural material by the automotive industry seems to be for semi-trailers and truck and trailer bodies. While relatively few such trailers and bodies have been built, the quantity of metal required for each is greater than the amount used for all other purposes in hundreds, probably thousands, of automobiles and trucks. The Edward G. Budd Mfg. Co. has applied its methods of building stainless steel railroad cars to the construction of truck and trailer tank, van, refrigerator and other types of bodies.

The advantages derived are a great saving in dead weight, freedom from oxidation and from corrosion by salts or acids, lack of need of painting, and reflection of heat from sunlight by the metal. Milk-tank semi-trailers are made with frame and corrugated outer shell of tank integral and the insulated inner tank of smooth stainless steel. Gasoline tank semi-trailers have rectangular corrugations in bulkheads and around the shell, with reinforcements, forming a complete structure to carry static and dynamic loads without a chassis frame.

A 24-ft. Budd van-type semi-trailer weighing only 4950 lb. carries a payload of 26,750 lb.—nearly five and a half times its own weight and double the total weight of tractor and trailer. Thirty-foot trailers having 1600 cu. ft. of payload space weigh 6050 lb., including integral frame and body, axle, wheels, tires and manually operated front-end support legs. Dead weight per cubic-foot capacity ranges from 4.36 lb. for a 24-ft. semi-trailer to 3.78 lb. for a 30-ft. unit, decreasing with increasing length. The saving of 1 ton in dead weight results in typical cases in increased payload revenue amounting to \$2,000 or more per year.

Composition and Properties of Stainless Steels

Properties of so-called 18-8 stainless steel that recommend it for structural purposes are stated



(Left) Trailer and stainless steel body built by Fruehauf Trailer Co. Photo by courtesy Republic Steel Co.

by E. J. W. Ragsdale, chief engineer of the Edward G. Budd Mfg. Co., as follows:

Corrosion resistance.

Great strength—90,000 lb. per sq. in. tensile strength when annealed and as much as double this figure obtainable by cold-rolling.

Ductility—cold-rolling leaves it in a state easy to fabricate.

High-temperature resistance—60 per cent of its strength retained at 1000 deg. Fahr.

High fatigue endurance—limit of 79,000 lb. per sq. in. as compared with 25,000 lb. for mild steel.

Sustained impact resistance at lowered temperatures—when cold-rolled to a tensile strength of 150,000 lb. per sq. in. it has an Izod impact index of 82 lb. at all temperatures from 70 to 100 deg. Fahr.

Resistance to weakening by welding—the only structural metal that is toughened by welding and that needs no annealing to correct it after welding.

The corrosion and heat-resistant steels are available from leading steel companies in a large variety of types having different compositions and balance of properties. They are produced and marketed in billets, hot and cold-rolled finished bars, heavy and light plates, hot and cold-rolled strips, seamless and welded



(Below) An a.c.f. Motors Co. motorcoach trimmed with stainless steel of 14-18 per cent chromium and 8 per cent nickel.



Sandwich buffet and water cooler of stainless steel in a.c.f. express parlor coach.

pipe, drawn tubes, and rolled and drawn rods and wire. Finished products, such as standard screws, bolts and nuts, nails, woven wire screen and cloth, rolled moulding, valves and so forth, are obtainable from fabricators.

The various rustless and anti-corrosion irons and steels are classified by the United States Steel Corp. in three fairly distinct groups, as follows:

Group 1—Alloys of relatively high-carbon steel and 12 to 14 per cent chromium, hardenable by heat treatment. Used mainly for cutlery.

Group 2—Low-carbon irons with about 17 per cent or more chromium. Not hardenable to any appreciable extent by heat treatment. Sometimes called ferritic steels to distinguish them from heat-hardenable martensitic alloys. Rustless under many conditions but not entirely satisfactory for severest exposure. Use limited largely to specific industrial applications.

Group 3—Relatively low-carbon iron with about 18 per cent chromium and about 8 per cent nickel in the most generally used type. Commonly called 18.8 but bearing a variety of trade names applied by different producing companies. Steels in this group are known as austenitic, as the alloys cause the iron grains to be present in non-magnetic austenitic, or gamma, form at ordinary temperatures.

The chromium alloy renders the iron resistant to

(Turn to page 416, please)

These Are the Tools of Tomorrow

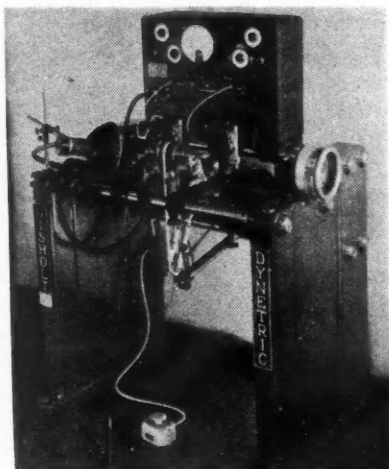
Gisholt "Dynetric" Balancing Machine

One of the most interesting new pieces of equipment developed by the Gisholt Machine Co., Madison, Wis., is the "Dynetric" balancing machine which provides modern means for quickly and accurately locating and measuring the unbalance in rotating parts or assemblies.

In the "Dynetric" balancer, the work piece is freely supported—not restrained at either end. Correction for unbalance is indicated directly at the points where corrections are to be made, and without stopping the machine.

The balancing is done at speeds to compensate for non-symmetrical distortion in the work. In the Gisholt Type S machine, the range of speeds at which balancing is done normally may be any speed from 750 to 2000 r.p.m. In the Type U machine, which is used for balancing larger parts, the range of speeds is from 300 r.p.m. and up. No manipulation or adjustment of speed is required.

This Gisholt machine can be arranged to measure either pure static or pure dynamic unbalance or the combined effect of static and dynamic unbalance in two arbitrarily selected planes of correction.



View of Gisholt 28 "Dynetric" balancer set up for balancing an armature.

Band Sawing and Filing Machine with 24-in. Throat

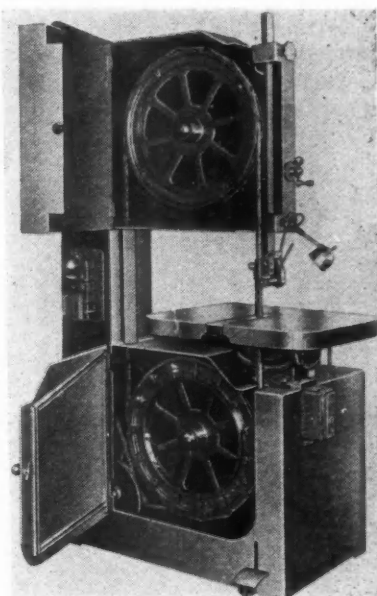
Grob Brothers, Grafton, Wis., have developed a band sawing and filing machine with a throat of 24 in. obtained by two 24½-in. diameter pulleys. The pulleys have inlaid rubber bands for the operation of the saw blade while alongside of the rubber band a groove is provided for the operation of the file chain. The lower pulley is driven by a ½-hp. motor by means of a V-belt reduction drive providing five speeds of 60, 90, 135, 225, and 375 ft. per min. to the saw band or file chain.

By tracking the saw blade and the file chain along-

side of each other, that is, each separately, a change from sawing to filing or vice versa can be made in less than a minute inasmuch as the saw guides and file attachments can be left in the machine at all times.

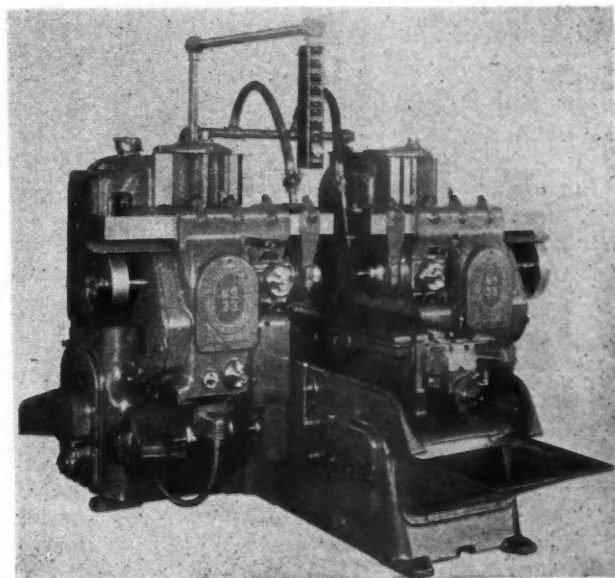
This machine is designated as the model NS-24.

Band sawing and filing machine, with 24-in. throat, built by Grob Brothers



Rigidmil Has Screw and Hydraulic Drive to Table

The new "No. 33 Hydro-Screw Rigidmil" developed by the Sundstrand Machine Tool Co., Rockford, Ill., has a table screw driven by a hydraulic transmission which provides an infinite number of feeds within the range of ½ in. to 60 in. per min. and a rapid traverse



Duplex type of No. 33 Hydro-Screw Rigidmil built by the Sundstrand Machine Tool Co.

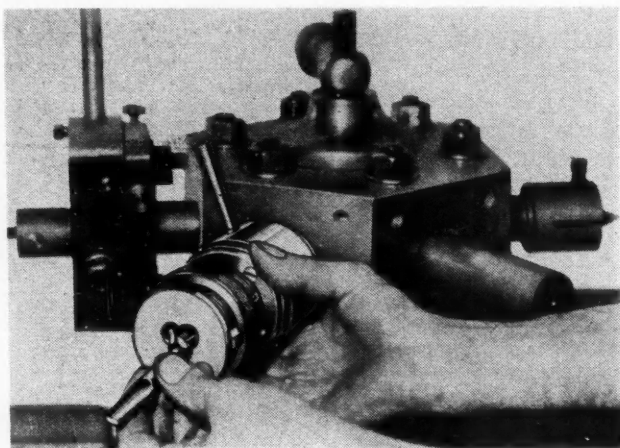
rate of 300 in. per min. With an efficient anti-back lash nut, the machine can be used successfully for climb or conventional milling.

Sundstrand has furnished machines of this type with 120-in. feed stroke and can provide machine requiring even greater length. Application can be made of single spindle, multiple spindle, horizontal or vertical heads in almost any combination.

Rickert-Shafer's Collapsible Tap

Rapid set-up and fast change of chasers are features claimed for the new collapsible tap brought out by the Rickert-Shafer Co., Erie, Pa. The same tool serves for either stationary or live-spindle use.

Only a $\frac{1}{4}$ -turn of the locking ring is required to re-

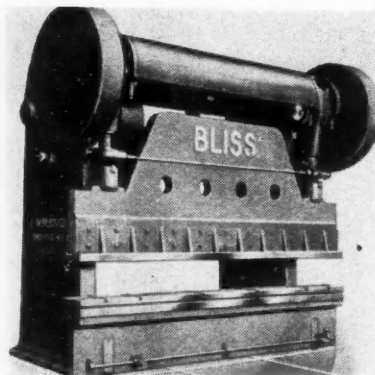


Rickert-Shafer's collapsible tap that features rapid set-up and fast change of chasers

lease chasers and a new set can be inserted in a few seconds. Setting the holder for tripping is done from the front end by a short turn of the micro-adjusting trip ring. The exact length to be cut can be scaled and the holder is instantly set to trip.

Press Brake Will Handle 1-2 by 12 in. Mild Steel

E. W. Bliss Co., Brooklyn, New York, has augmented its line with a press brake having a capacity of $\frac{1}{2}$ in. by 12 in. mild steel. Through the use of the "Bliss"



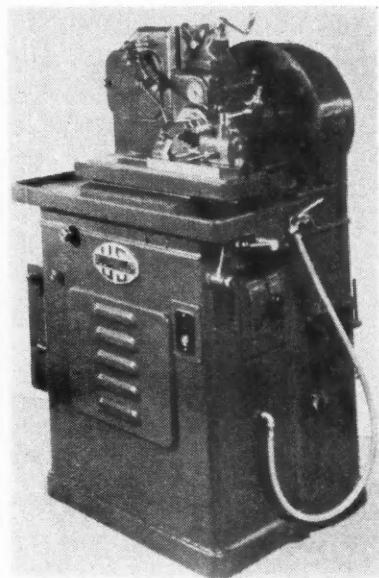
Bliss press brake with capacity of $\frac{1}{2}$ in. by 12 in. mild steel.

gear reduction unit, the strokes per minute on this machine can be changed from 10 s.p.m. to 20 s.p.m., according to operating conditions. Operation of this machine is controlled through the action of a newly designed hydraulic clutch with push button con-

trol for inching and stopping at any points of the stroke. The clutch also can be controlled by means of a foot-treadle arrangement which can be tilted out of the way so that it is impossible to trip the brake with the foot-treadle while the machine is arranged for hand operation.

Automatic Production Milling Machine

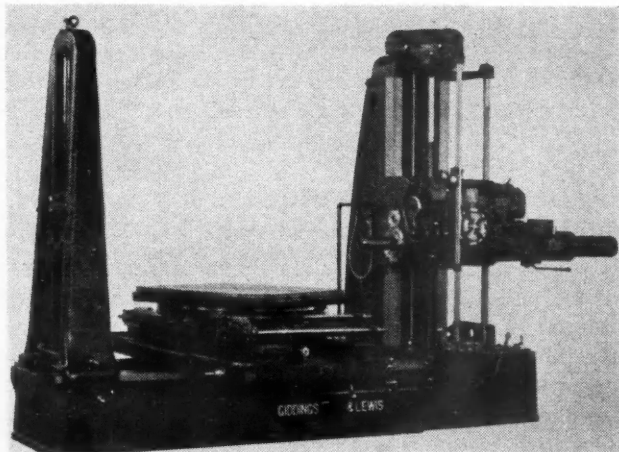
Announcement of a new model "Multi-Miller" has been made by U. S. Tool Co., Inc., Ampere (East Orange), N. J. Designated as MM-52, the new automatic production milling machine is built with cam controlled automatic vertical feed of the spindle head. By synchronizing the cam controlled vertical feed and the cam controlled table feed, it is possible to use the MM-52 for profiling operations. One operator can attend to as many as six machines inasmuch as the operator is required for loading and unloading only.



Automatic production milling machine with six-inch table travel and two-inch vertical feed. It is model MM-52 in the U. S. Tool Co.'s line.

Giddings & Lewis Augments Line of "30 Series" Machines

A built-in power revolving table type machine has been added to the "30 Series" of high power, precision



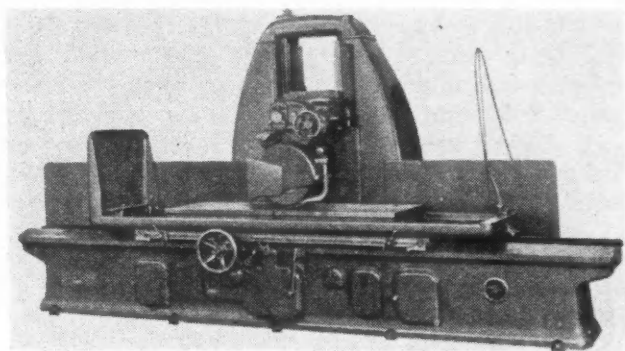
The Giddings & Lewis built-in power revolving table type horizontal boring, drilling and milling machine.

horizontal boring, drilling and milling machines built by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The power revolving table feature increases flexibility and reduces set-up costs because it allows complete turning of a job to any position within the full 360 deg., permitting the machining of a job on different sides in one set-up and eliminating the necessity for mounting and dismounting an auxiliary revolving table with the resulting time consuming operations.

High-Powered Precision Surface Grinder with Hydraulic Feeds

The latest design of high-powered precision surface grinders manufactured by the Mattison Machine Works, Rockford, Ill., can be furnished with table widths of 12 in., 14 in., 16 in., 18 in., 20 in., 24 in., and 30 in., and lengths up to 16 in.

Important characteristic of the Mattison grinder is the massive double column support for wheel slide assembly. Wide bearing surfaces on the face of columns and dovetail bearing surfaces on the back provide an eight-point support which the manufacturer



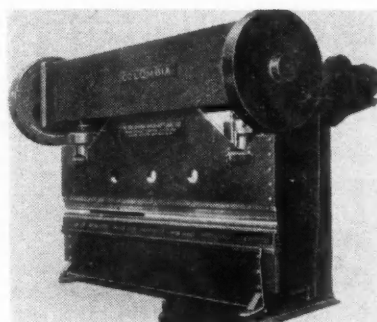
The Mattison Machine Works builds this high-powered precision surface grinder.

claims assures absolute stability. The wheel spindle with its totally enclosed, built-in motor is mounted in an exceptionally heavy housing.

Columbia Steel Power Press Brake

A full range of steel power press brakes is being manufactured by Columbia Machine Tool Co., Long & Allstatter Division, Hamilton, Ohio. The smaller sizes are made with a single-gear drive, while the two largest have a twin-gear drive as here illustrated.

The housing, slide, and base are made of extra thick, open-



Columbia steel power press brake, twin-gear type.

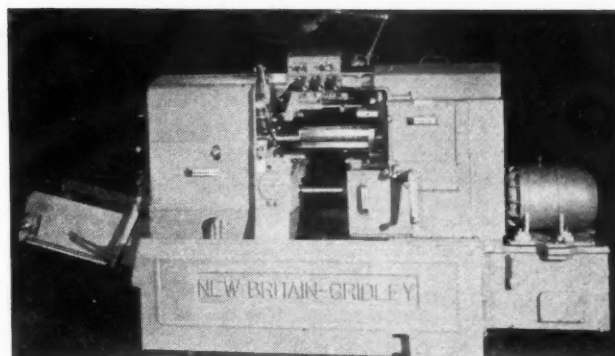
Automotive Industries

hearth, rolled steel plates which are burned to the desired shape. The jointing surfaces are accurately machined, so that a very rigid unit is produced. Slide and base are of sufficient depth so that when the machine is working at full capacity, the deflection is less than 0.001 in. per foot of width, it is claimed.

Drive is by multiple V belts from a pulley on the armature shaft to the flywheel, belt tension being adjusted by means of the motor bracket.

New Britain Automatic Screw Machines

Many improvements are incorporated in the line of New Britain multiple-spindle automatic screw ma-



New Britain-Gridley Model 60 six-spindle automatic screw machine built by New Britain-Gridley Machine Division of the New Britain Machine Co., New Britain, Conn.

chines. The entire line includes a mechanism which automatically lifts the carrier off its locating seat just prior to indexing, and holds it off this seat during the indexing movement. After indexing is completed, the carrier is firmly located in position and securely clamped by a carrier-clamping mechanism, which is said to preclude any weave during the cutting cycle.

Another feature is the circular-section forming-slide construction, wherein the circular slide reciprocates on a hardened and smoothly-finished steel stud, which stud in turn is rigidly supported at both ends. The circular slide is equipped with hardened bushings, and the whole mechanism is completely enclosed.

Two New Machines of the George Gorton Line

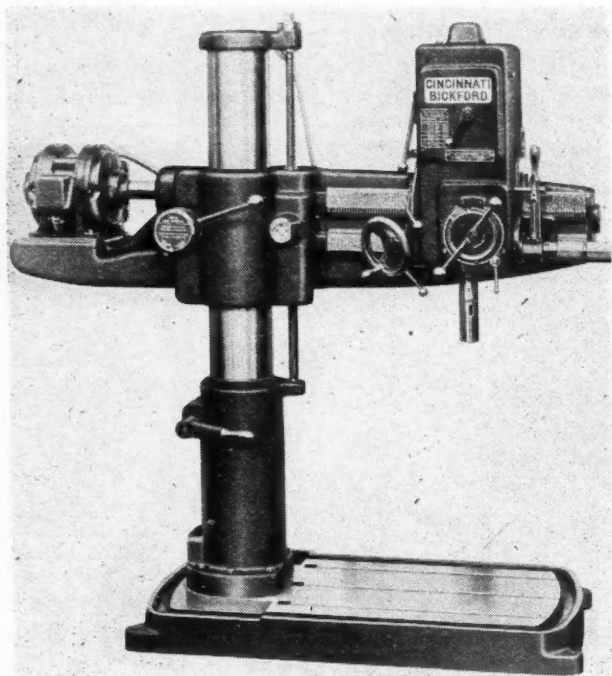
New machine tool products of the George Gorton Machine Co., Racine, Wis., include the 15-B Mastermil and the 8½-D super-speed universal. The 15-B Mastermil is a large high-speed vertical spindle machine combining die-duplicating with die-sinking operations, including radius milling and angle cutting. It is also equipped for jig boring. Work range of this machine is 30 in. by 30 in. by 30 in. There are centralized controls for all table and spindle movements. Spindle speeds range from 40 to 2800 r.p.m. Other specifications include maximum power input to spindle of five horsepower, and infinite table feed variation from ¼ in. to 30 in. per min.

The 8½-D super-speed universal is of the same size, capacity and weight as the company's 8½-D super-speed vertical.

October 1, 1939

High-Speed, All-Geared Small Radial Drill

Recent addition to the line of radial and upright drilling machines built by the Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio, is a high-speed, all-geared small radial drill adaptable to regular production. It was developed especially for manufacturers whose operations include much small drilling and tapping in fairly large parts—work that is handled gen-



High-speed, all-geared small radial drill built by Cincinnati Bickford Tool Co.

erally on large upright drills or on belt driven radials of the sensitive type.

Three changes of spindle speed are controlled by the upper lever at the left of the head. With a 1200 r.p.m. driving motor the speeds can be in any one of several optional ranges. Six spindle speeds can be obtained by using a two-speed A.C. motor instead of the constant speed type.

Three rates of power feed, 0.003 in., 0.006 in., and 0.009 in. per revolution of spindle are instantly available by setting the direct reading lever at the center of the head.

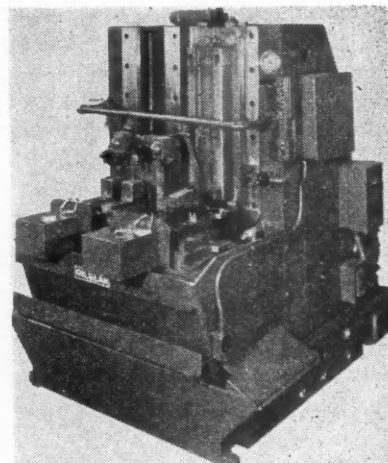
Oilgear Adds Four New Broaching Machines

Four new styles of broaching machines have been added to the line manufactured by the Oilgear Co., Milwaukee, Wis. These are as follows: Type "SX" single slide vertical surface broaching machine; Type "XD" double slide vertical surface broaching machine; Type "XP" vertical pull-down broaching machine; and Type "XM" vertical cyclematic broaching machine.

The five sizes of type "XD" which are offered vary in normal capacity from three to 25 tons and in broaching strokes from 30 to 66 in. Outstanding fea-

tures of the new machines are listed by the manufacturer as dual safety pushbutton control with selector switch for manual, semi-automatic or full-automatic operation . . . convenient knee bar for emergency stop . . . ample surfaces on shuttle tables and tool slides for mounting a multiple of fixtures and tools . . . rectangular

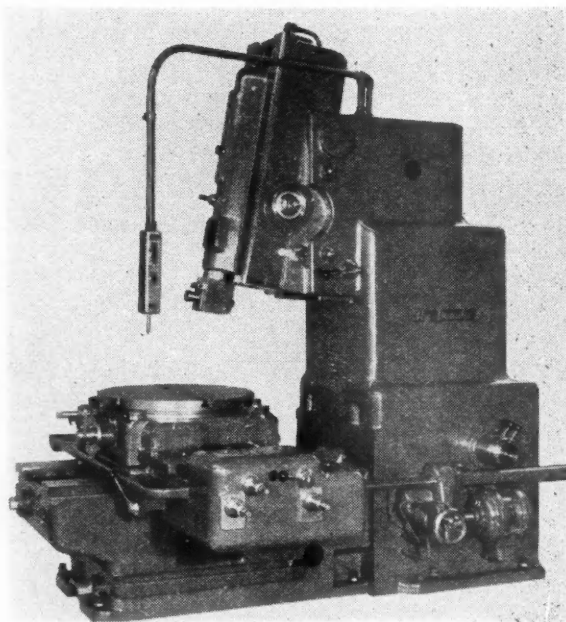
hardened and ground ways for shuttle tables and tool slides with gib type adjustment for working clearances . . . automatic pressure lubrication of shuttle and tool ways and shuttle operating mechanism . . . hydraulically and mechanically operated shuttle tables with positive interlock operation of shuttle tables and tool slides . . . alternative operation of shuttle tables and tool slides . . . micrometer type positive stops for precise positioning of shuttle tables in broaching position . . . tool slide rams in tension when broaching . . . vertical motor driven coolant pump and Oilgear controlled fluid power operation.



Type "XD" broaching machine, one of four new styles announced by the Oilgear Co.

Rockford Develops A 12-In. "Hy-Draulic" Vertical Shaper

New member of the family of "Hy-Draulic" machine tools made by the Rockford Machine Tool Co., Rockford, Ill., is a 12-in. vertical shaper. The machine



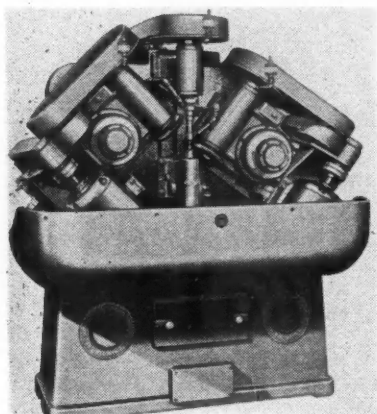
Rockford Machine Tool Co.'s 12-in. "Hy-Draulic" vertical shaper.

is described by the manufacturer as "a smaller counterpart of the Rockford 20-in. Vertical Hy-Draulic Slotter."

In addition to the qualifications of power and rigidity demanded by the heavier class of vertical shaping, this new machine incorporates speed and accuracy, the hydraulic drive of the ram being so designed as to give a total of 150 strokes per minute on the minimum stroke of one inch, while the table is provided with micrometer adjustments for setting in longitudinal and lateral travel. Provision is made also for the use of dial indicators and precision measuring bars for accurate setting, following the same method as is used in precision table setting in jig boring machines.

"National" Gear-Shaving Machine

The new RotoShaving machine built by the National Broach and Machine Co., Cleveland, is an application of special circular shaving cutters to the work of



Red Ring RotoShaving machine.

finishing metal surfaces. In precision this operation is said to be equivalent to production grinding, but it is more economical. It is replacing green grinding where the hardness of the work piece does not exceed 30 Rockwell. It is useful in truing up and in the finishing of locating surfaces where subsequent ma-

chining operations are contemplated. Surfaces finished in this way are said to smooth and true and to have a texture similar to that of a ground surface.

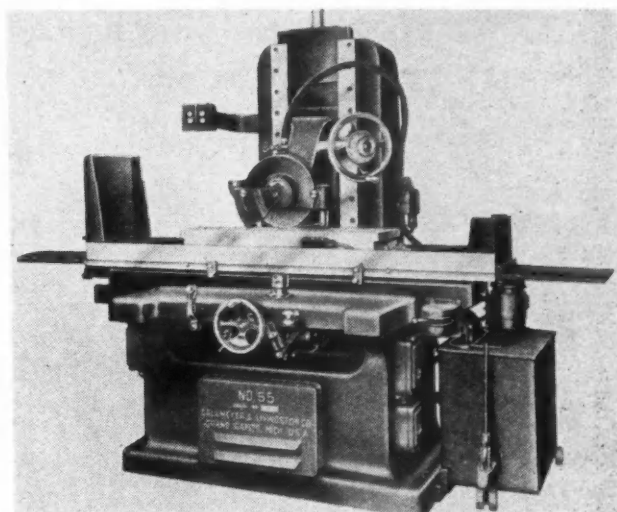
Tool Room Type Hydraulic Feed Surface Grinders

A number of refinements have been made in the design of the No. 55 precision tool room type hydraulic feed surface grinders built by the Gallmeyer & Livingston Co., Grand Rapids, Mich. These machines are available in sizes ranging from six in. by 18 in. working surface of table to 14 in. by 48 in. working surface of table.

The No. 55 tool room type grinders have hydraulically actuated cross feed which may be set to operate at each reversal of the reciprocating table or at one end of the stroke only. The amount of cross feed is adjustable and can be set to feed either in or out as desired.

Drive for the spindle is through V-belts by a motor mounted on an adjustable bracket attached to the head of the machine. This construction eliminated the old

idler jack arrangement and permitted provision for two spindle speeds so that after a number of worn wheels have been accumulated the speed can be increased and the worn wheels used advantageously.



No. 55 precision tool room type hydraulic feed surface grinder manufactured by Gallmeyer & Livingston Co.

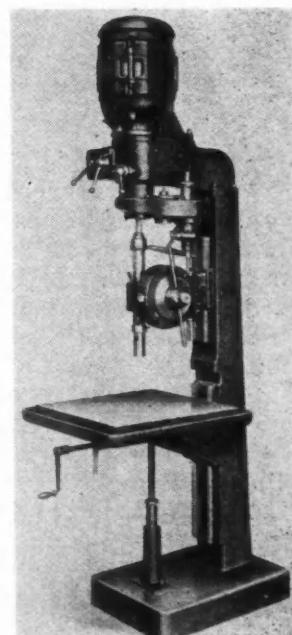
Blanchard's New Surface Grinder

The Blanchard Machine Co. has announced an entirely new small surface grinder, the No. 11, which supersedes the No. 10 Blanchard grinder. The new machine considerably surpasses the No. 10 in capacity, power and rigidity and is capable of very fast work. Its larger wheel operating at a lower wheel speed results in faster and cooler grinding with less wheel wear. In its design, special attention has been given to ease and speed of handling and all controls are conveniently placed for quick operation with a minimum of effort.

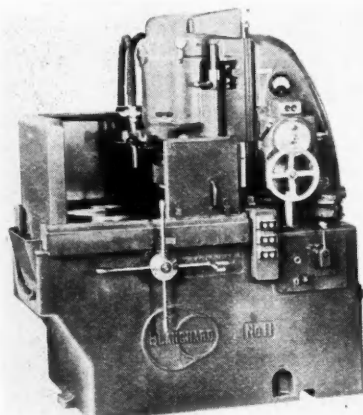
The No. 11 Blanchard grinder uses a cylinder wheel 11 in. outside diameter, 5 in. deep and 9 in. inside

Newcomers to the line of drilling machines built by the Buffalo Forge Co., Buffalo, N. Y., are the Nos. 2 and 3 motor spindle machines of the type shown. The No. 2 is available in 8-in., 12-in. and 15-in. overhand, in bench and pedestal models. It has a 2-hp. motor available in three different speed ranges.

The No. 3 is available in 12-in. overhang and pedestal model only. It can be had with 2-hp. or 3-hp. motors and one medium-low speed range. Both of these models are built in multiple units of from one to six spindles



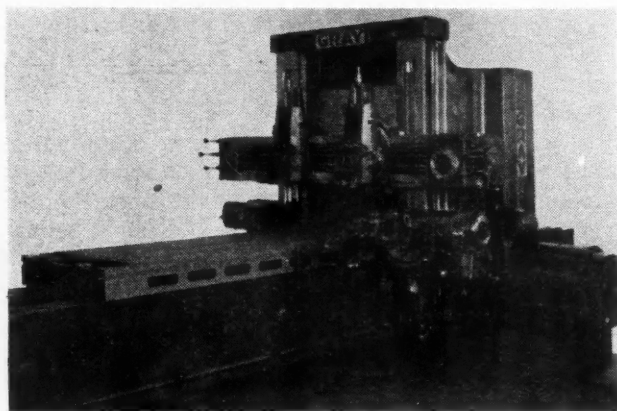
diameter driven by a 15 hp. induction motor directly on the wheel spindle and has a capacity for grinding work up to 20 in. diameter by 8 in. high under a new wheel. It is driven by a total of four motors, each direct coupled to its load. One of these motors provides for rapid raising and lowering of the wheel head by power, with push button control.



No. 11 Blanchard surface grinder

New Planer Designed By the G. A. Gray Co.

A new "Maximum Service Planer" built by the G. A. Gray Co., Cincinnati, Ohio, differs radically both in productive efficiency and appearance from previous tools of this type. Due to improvements in control and drive the time formerly required to do the actual planing can frequently be cut in half and, according to the manufacturer of this equipment, in many cases even greater savings are possible.



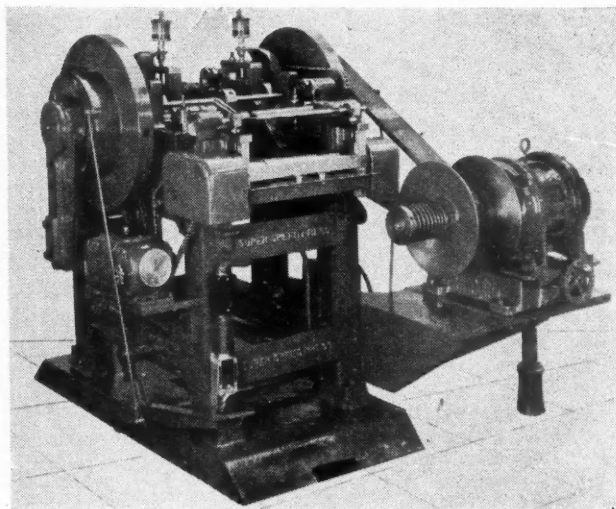
G. A. Gray Co.'s newest "Maximum Service Planer."

Variable voltage drive in conjunction with a five to one all-helical gear train affords both cutting and return speeds ranging from eight feet to 240 ft. per min. The builder of this equipment states that the drive is so efficient that 50 round trips per minute of the table can be made without shock or knock at the moments of reversal.

Super Speed Punch Press

New principles in the field of press design are embodied in a press now being manufactured by the Ferracute Machine Co., Bridgeton, N. J., for the Super Speed Press Corp., New York.

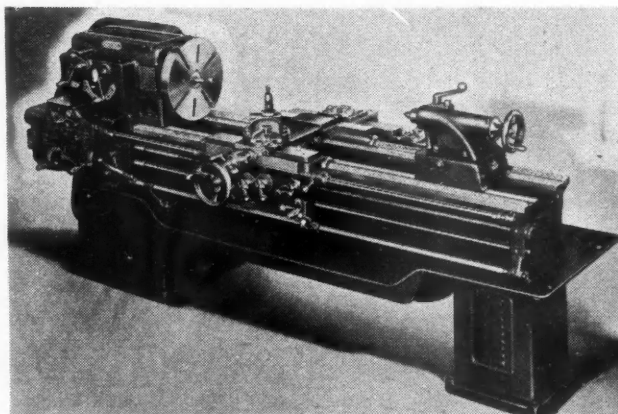
The die bed of the Super Speed press reciprocates in a horizontal plane, the amount of travel approximating the amount of feed per piece. The punch member takes its motion directly from the crankshaft, the amount of stroke being adjustable. This rotary motion of the punch face coincides at its lower arc with the reciprocating die on its forward stroke. Gripped by the stripper, the material is held between the punch and die, the whole traveling forward horizontally as the punch penetrates the work, passes the center point and withdraws from the work, the stripper clearing the punch.



The Super Speed punch press built by Ferracute.

Herringbone Geared Headstock Is Feature of Sidney Lathe

The new Sidney lathe, manufactured by the Sidney Machine Tool Co., Sidney, Ohio, is a complete anti-friction bearing machine with anti-friction bearings mounted in the headstock, end gearing, gear box, apron, lead screw and feed rod, and ball thrust bearings on all adjusting screws. It is provided also with automatic lubrication in the headstock through pump and piping including the apron and carriage mechanism, with a centralized reservoir for lubricating the gear box. The gears throughout the entire lathe, in-



A 16 in. by 30 in. center lathe built by the Sidney Machine Tool Co.

cluding all other wearing parts, are of heat treated and hardened steel.

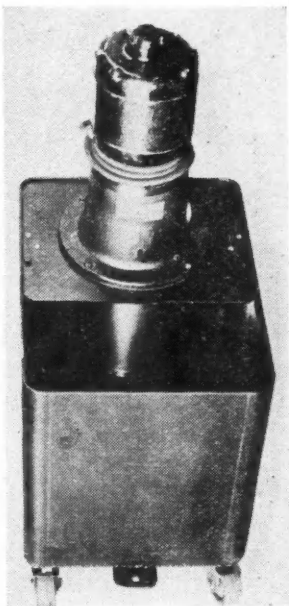
A herringbone geared headstock with internal and external gear tooth clutches is an important feature of the machine.

The new Sidney lathes are built in sizes from 14 in. to 36 in. swing in either eight, 12 or 16 speed headstocks.

Filter Built to Handle Grinding Coolants

Designed principally for filtering grinding coolants consisting of soluble oil and water, kerosene or other light coolants or cutting oils, a new coolant filter is being made by Motor Improvements, Inc., Newark, N. J., in three sizes with capacities of 20, 40, and 75 g.p.m., respectively.

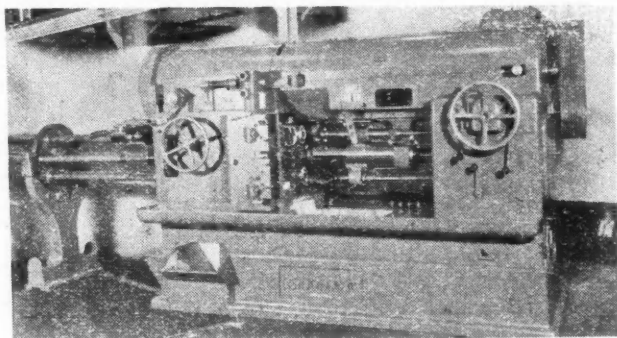
The filter is installed in the existing tank or an additional one and is complete within itself, having a motor pump, and filtering element, all in one assembly. Clean coolant is supplied continuously to the work and wheel, minimizing scratches, reducing grinding time, saving coolant, and lengthening intervals between dressings.



Filter built by Motor Improvements, Inc., which is designed principally for filtering grinding coolants

Conomatic Six-Spindle Automatic Screw Machine

Many improvements have been incorporated in the six-spindle Conomatic, manufactured by the Cone Automatic Machine Co., Inc., Windsor, Vt. One of these is the open-end gearing. The power-feed change gears are conveniently located just inside the cover at the end of the machine. Attachments can be placed in operation in a minimum of time, it is claimed. The high-and-low-speed cam action may be disconnected by the operator when checking tools. Power-feed en-



Conomatic six-spindle automatic screw machine.

agement operates by a touch of the lever and may be disengaged from either side of the machine. The power-feed countershaft provides a wide range of feeds and a slow speed for tooling that can be instantly moved to high or production feed.

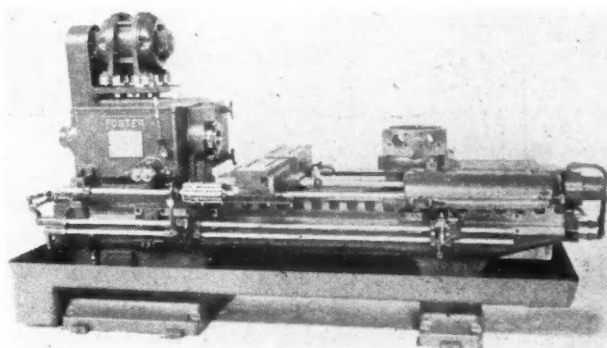
New Automatic Turret Lathe Built By Foster

The Foster Machine Co., Elkhart, Ind., has developed a new model "Fastermatic" machine, or automatic turret lathe. An outstanding advantage claimed for the 2-F machine is reduction in set-up time.

Many changes have been incorporated into the design. The head is entirely new and regularly has 28 changes of speeds, from 17 to 263, or higher if desired. These changes are arranged in seven sets of four automatic changes. Any group of four automatic changes may be selected quickly by the application of the proper set of pick-off gears.

There is a station on the spool for each tool station of the hexagon turret. The spool indexes with the indexing of the hexagon turret, bringing a separate station with a separate set of buttons in position to effect the automatic spindle speed changes predetermined for that working face of the turret. It also travels forward and backward with the movement of the turret unit.

The number of automatic changes to a single face of the turret, when traveling forward, is determined by the number of buttons on the spool, and the longi-



Foster Machine Co.'s new 2-F automatic turret lathe.

tudinal positions of the buttons on the spool determine when the spindle speed changes will be effected. The changes may be made any time during the cut, or at the end of the stroke if desired. It is possible to have four automatic spindle speed changes during one forward movement of the turret, or with every forward movement of the turret if desired. When no automatic spindle speed changes are required, the buttons are removed from the tee-slots in the spool.

Potter & Johnston Automatic Chucking Machines

Potter & Johnston Machine Co., Pawtucket, R. I., had intended to exhibit at the now-canceled Cleveland Machine Tool Show the latest developments in their automatic chucking machines in both the single- and

double-spindle types. These were to have been equipped with special tooling and shown in operation, to demonstrate their applicability in many production problems.

The 5D automatic, while it has been standard in general design for some years past, has been constantly improved in details. The unit is of the automatic chucking type, equipped with a turret.

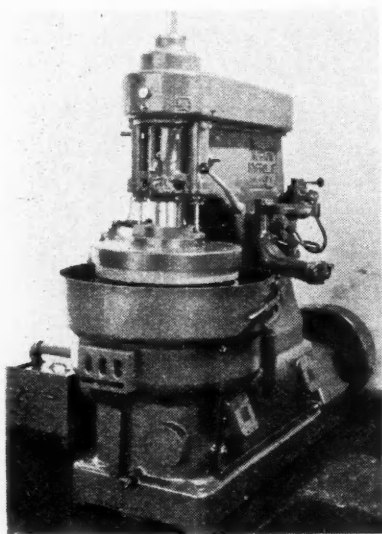
The 6DREL automatic also is a standard P. & J. design involving many detail improvements. It is of the automatic chucking type, equipped with a turret.

The 5D-2-9 automatic is a new model of the two-spindle chucking type, with turret and cross slide. The machine is a smaller edition of the now well-known P. & J. 5D-2-12-in. and 15-in. automatics. It had been planned to demonstrate this machine with special tool equipment to bring out its versatility.

The 3-U automatic also is a new model, of the single-spindle chucking variety, with turret and cross slide. Simplicity, ease of set-up, accuracy, low maintenance cost, and high productivity are claimed to be virtues of this machine, which is specially adapted to the economical manufacture of small parts.

Production Lapping Machine Uses Bonded Abrasive Laps

A new Norton Co. "Hyprolap" machine is known as the No. 26. It uses two bonded abrasive laps and is



Norton Co.'s new production lapping machine, known as the No. 26 "Hyprolap."

an extremely fast cutting machine, the number of parts finished simultaneously in one load depending upon their size. Automotive parts, such as piston rings — in fact, any flat part the size of which is within the machine's capacity can be finished flat and parallel within extremely fine, pre-established limits.

The machine can be adapted for either flat or cylindrical work.

A lever regulates the lapping pressure, which can be adjusted for from 20 to 100 lb. per sq. in. A hydraulically controlled swinging arm carrying two diamonds trues the upper and lower lap faces simultaneously.

New Crossed-Axis Gear Finisher

A companion machine to the Michigan Tool Co.'s improved "860" rotary crossed-axis gear finisher, the Michigan 860-A embodies provisions for finishing gears up to five inches in width, as well as splines on

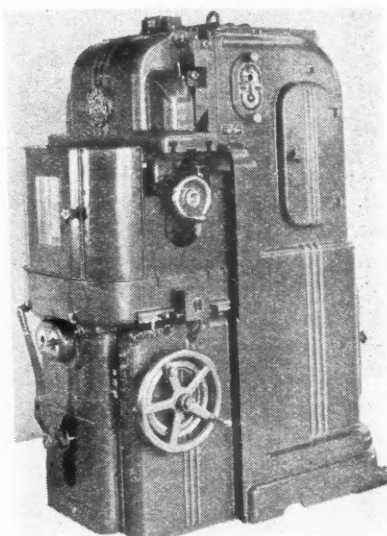
long shafts, without requiring wide cutters.

For such work the standard fore and aft table feed is locked out, and a combination of reciprocating transverse workhead travel and vertical table feed is cut in.

A selector switch permits ready change from the underpass method of finishing gears of more conventional size to the transverse feed method. When the latter is used, the cutter carrying table is locked in a central position and feed becomes vertical, by automatically raising the knee of the machine a fixed amount each stroke of the reciprocating head.

Operation of the feed is through "Cone - Drive" area contact worm gearing, as is the drive to the head for transverse reciprocation. The use of this gearing provides greater smoothness of operation, resulting in finer finish and longer tool life.

The new 860 A is available in three sizes, for finishing gears up to eight in., 12 in. and 16 in. in diameter. Maximum distance between work carrying live centers is 18½ in., but by means of an optional offset special headstock, this may be increased to 25½ in.

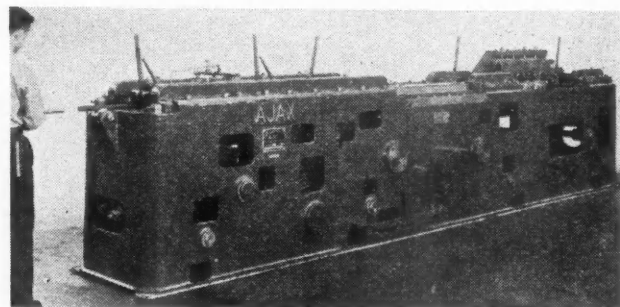


Michigan Tool Co.'s model 860-A crossed-axis gear finisher

Continuous Drawing and Straightening Machines

The Ajax Mfg. Co.'s continuous drawing and straightening machines are a new development in the cold drawing field. In one pass through the machine, cold drawn bars are produced accurately to size and commercially straight ready for use in automatic screw machines and for many other applications.

The operation of these machines appears to be extremely simple. The operator starts a hot rolled,



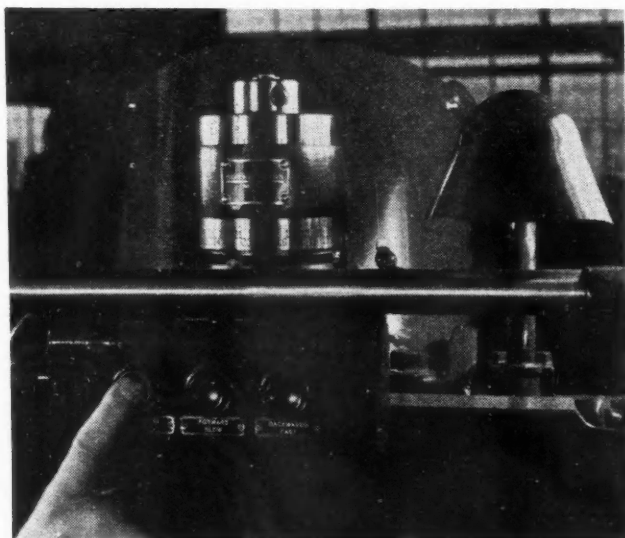
Ajax continuous cold drawing and straightening machine for producing straight cold drawn bars.

pickled and limed bar, or a hot rolled blast cleaned bar into an inching slide. The inching slide grips start the bar through the drawing die, eliminating any pointing operation. After passing through the die, the bar is gripped by the first drawing slide grips, and after advancing, passes into the second drawing slide grips, after which the bar is pulled at a uniform speed through the drawing die by hand over hand operation of two drawing slides. As one slide pulls the bar, the other returns, and the pulling strokes overlap, keeping the bar always in motion.

The bar is then pushed through a horizontal straightener in the freshly drawn condition, before any appreciable age hardening takes place. Very little over bending is required in the straightening rollers, because the bar is drawn in a straight line and securely held by the drawing grips, which tend to keep it straight. What little over-bending is required is done while the ultimate strength of the bar is still low, and the manufacturer states that the resulting low roller pressure eliminates distortion of the bar almost entirely. The bar then passes through the feed slide, and is pushed through the vertical straightener. It then passes through the last feed slide. After the trailing end of the bar has passed out of the drawing slides, the feed slide grips then grip it and feed it out of the machine onto the run-out table.

Power Back Gage Saves Time on All-Steel Shear

Savings in operator's time, greatly increased gaging speeds, and fine accurate settings are named as



Finger tip control and easily read dials on the Cincinnati Shaper Co.'s new front controlled power back gage. The gage is optional equipment on the Cincinnati all-steel shear.

the important advantages of the front controlled power back gage which the Cincinnati Shaper Co., Cincinnati, Ohio, now provides as optional equipment on its all-steel shear.

Finger tip push button control is from the front of the shear, conveniently located at the operator's position. Dials reading in inches and sixty-fourths or

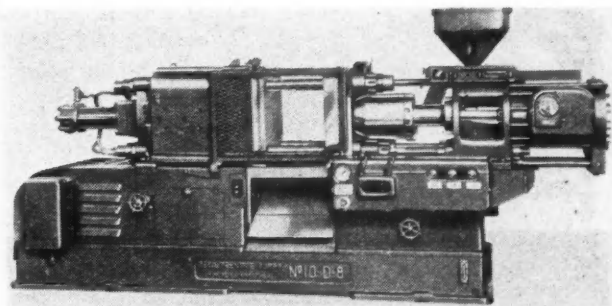
Automotive Industries

finer are mounted in front above the finger tip control. A fast forward and a fast backward speed give rapid movement to the desired position. A "spotting" button sets the gage accurately.

The gage is said to be especially advantageous in work requiring frequent changes of back gage setting.

Reed-Prentice Plastic-Injection Molding Machine

This machine built by Reed-Prentice Corp., Worcester, Mass., for making moldings of plastic material by the injection process can be worked either manually



Reed-Prentice plastic-injection molding machine

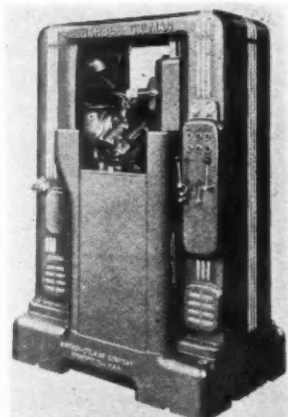
or automatically. When manually operated the machine is controlled by the two levers on the front. One of these closes the mold, while the other starts the injecting operation. Reversal of the levers opens the mold and brings the plunger back ready for the next injection.

When automatically operated, the machine is controlled through three time clocks adjustable from 0.2 sec. to 120 sec. One time clock determines the time the pressure stays on the plunger; one determines the period for the solidification of the material, and one determines the time the mold is open for the ejection of the product.

Barber-Colman Vertical Hobbing Machine

The Type V automatic hobbing machine, manufactured by the Barber-Colman Co., Rockford, Ill., was designed for high production, accuracy, and fine finish. Advantages of the vertical design are that the machine requires little floor space, is very accessible from both front and rear, and is very rigid. Chips and coolant fall directly into the chute provided for them.

An automatic operating cycle is employed. Hydraulic pressure is used to actuate the hob carriage, clutches, and clamping



Barber-Colman vertical gear hobber.

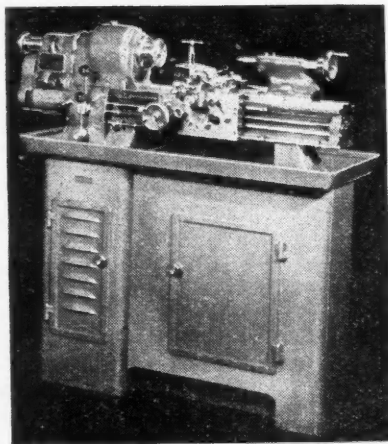
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means; mechanical drive to operate the hob spindle and clamping means, and electric drives to operate the hydraulic unit, coolant pump, and work-slide rapid traverse. The cycle includes rapid traverse with conventional or climb cutting, as determined by the setting of the controls.

All shafts are short, and the drive shafts run in anti-friction bearings. Gears are hardened and lapped, and said to run quietly at high speeds. The machine has large box-section columns mounted on a heavy base and reinforced by the crown member at the top. The hob-spindle slide is dove-tailed in a heavy swivel base with worm wheel vernier angular adjustment. The hob spindle is hardened and ground, and is mounted in precision bronze bearings which are rigidly supported and independently adjustable. Accurate depth of cut is assured by a micrometer adjustment for the positive stop.

Hardinge High-Speed Precision Screw-Cutting Lathe

A feature of this lathe (manufactured by Hardinge Brothers, Inc., Elmira, N. Y.) is the dove-tail carriage and bed construction. The thrust due to the cutting action is taken on 30-deg. ways on the back of the lathe bed, the reaction of which forces the carriage down on the bearing surfaces on top of the bed. The heavy box-section bed is an alloy semi-steel casting



Hardinge screw-cutting lathe.

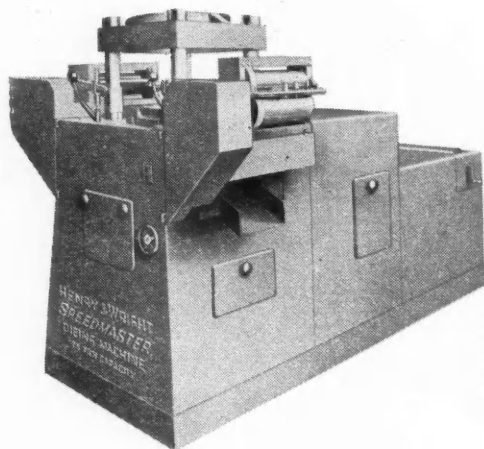
and is heat-treated. All important bearing surfaces are hand-scraped. The bed has substantial individual base supports at each end. Two steel balls at the headstock end and one at the tailstock end provide a three-point bearing between the bed and base supports. The base supports are secured to the bed

by spring-backed bolts, to eliminate the possibility of bed distortion due to floor irregularities.

Drive is by a standard two-speed motor through V-belts to a four-step aluminum pulley, the combination giving eight forward and eight reverse spindle speeds ranging from 165 to 1750 r.p.m., and with the 6.25: 1 back gears engaged, from 27 to 280 r.p.m.

High-Speed 25-Ton Dieing Machine

A high-speed 25-ton dieing machine is the newest equipment to come out of the plant of the Henry & Wright Mfg. Co. in Hartford, Conn. While it incorporates the basic principles previously used in dieing machines made by this manufacturer, there are a number of added features, including new counterbalancing,



25-ton high-speed dieing machine built by the Henry & Wright Mfg. Co.

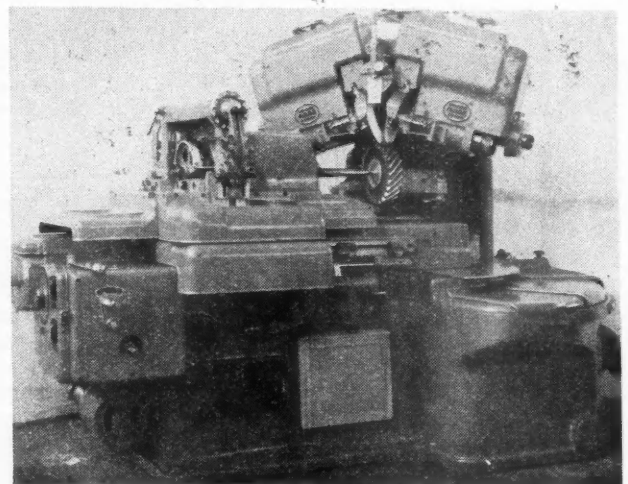
new precision feed drive, variable speed machine drive, new bearing and lubricating provisions for high-speed operation and special control provisions.

The equipment is capable of operating at 600 strokes per minute with progressive dies. It is not limited to blanking and piercing, but will perform these operations plus drawing, forming and extruding.

Maag Gear-Grinding Machine

Two new machines have been announced by Triplex Machine Tool Corp., New York—the Swiss jig-boring machine MP-4G of the Société Genevoise, and the Maag type HSS-30 grinding machine for helical and spur gears.

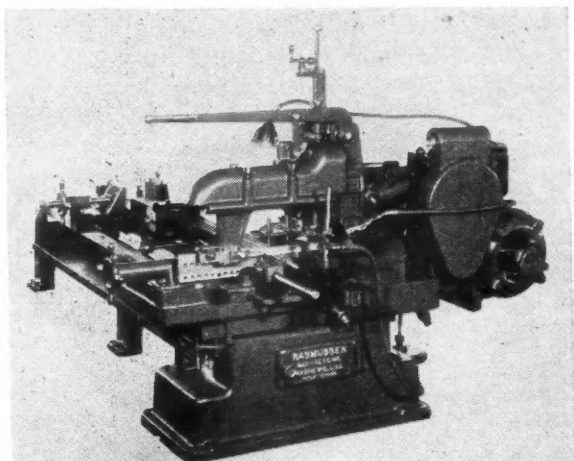
Like all Maag gear-grinding machines, the HSS-30 works on the generating principle. The grinding operation is carried out by means of two saucer-shaped grinding wheels which work only with their extreme edges. The planes of the two grinding circles form the ideal rack tooth which, together with the generating motion of the gear to be ground, produces two correct involute flanks. Special involute teeth can be ground as easily as standard teeth. A pitch block and steel bands produce the generating motion, in accordance with the geometrical formation of the involute. The axial feed and the generating motion take place at the same time, which results in the criss-cross marks that are characteristic of this method of generation.



Maag Type HSS-30 gear-grinding machine.

"Sawmore" Metal Cutting Machine

Rasmussen Machine Co., Inc., Racine, Wis., has brought out a new "Sawmore" metal cutting machine. Like all machines in this line, the new model swivels on its base for angle cutting. A positive compensating feed allows faster cutting inasmuch as the saw blade encounters less metal. This feed is also adaptable to the new two-tooth blades with cutting speeds of from 10 to 15 sq. in. of steel per min.

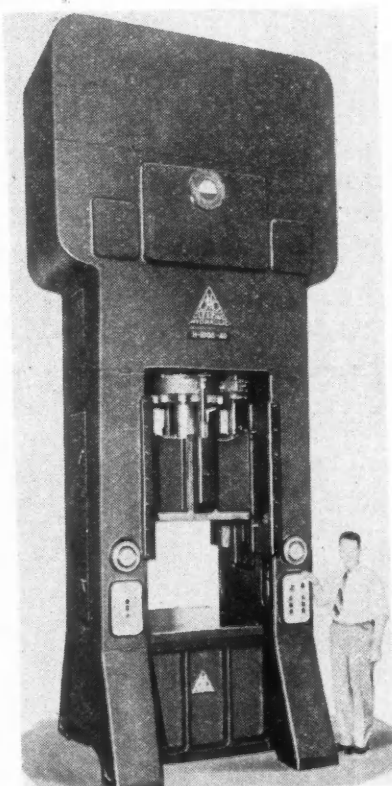


Rasmussen "Sawmore" metal cutting machine.

The Clearing Hydraulic Press

A single-action, double-pressure, hydraulic press, developed by the Clearing Machine Corp., Chicago, combines the mechanical features of the firm's well-known crankless power presses with a simplified hydraulic operating system.

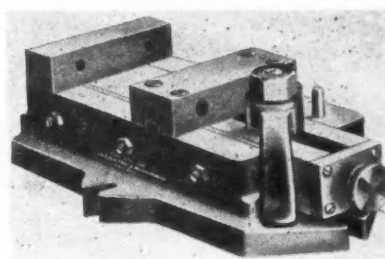
The accompanying illustration shows a new type H1500-42 press of 500 tons capacity, with a bed area of 42 by 38 in., a stroke of 24 in., and a shut height of 20 in. It has a dual-pressure hydraulic system giving a very rapid approach stroke, a high-speed pressing stroke up to a pressure of 175 tons, a slow-speed high-pressure stroke above 175 tons, and a very rapid return stroke.



Clearing 500-ton hydraulic press.

Automotive Industries

The Chicago Tool & Engineering Co.'s new 2½-in. production vise.



Production Vise for Milling, Drilling and Grinding Operations

The Chicago Tool & Engineering Co., Chicago, has added a 2½-in. production vise to its line of Palmgren angle and production vises. The new vise is intended for high production in connection with milling, drilling and grinding operations.

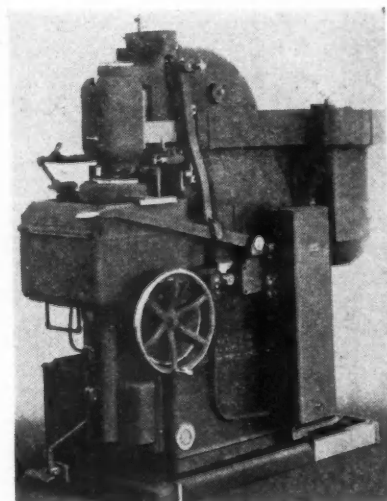
An adjustable cam locking lever which works against a hardened steel surface permits rapid loading and unloading by a single movement of the lever. A hand screw is provided for quick adjustment when a change to a different size piece is necessary. Lugs are provided on the sides and ends for secure bolting to the machine table. There are adjustable plates so that side wear can be taken up. All movable parts are hardened and ground.

Single Stroke Surface Grinder

O. S. Walker Co., Inc., Worcester, Mass., has redesigned and improved several features of its single stroke surface grinder.

On the latest design the wheel spindle is driven from a 10 hp. motor vertically mounted on the back of the column. Power is transmitted through a horizontal belt with a suitable binder pulley. A separate 1½ hp. end shield motor mounted at the rear of the machine base provides for the table drive. Starting and stopping of the table is controlled automatically by raising or lowering the wheel head as is also the magnetizing and demagnetizing of the 12-in. magnetic chuck.

Six table speeds are available and a foot brake facilitates quick stopping of the table. A Fulflo pump, driven by a ¼ hp. motor, is installed in a 30-gallon coolant tank.

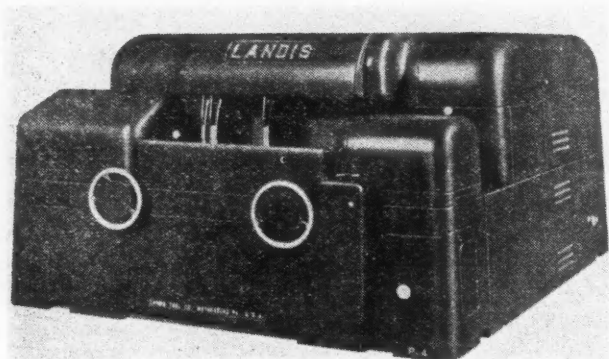


Improved Walker single stroke surface grinder.

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Completely New Landis Hydraulic Grinder

A completely new machine added to the Landis Tool Co.'s line is the 16 in. by 40 in. type IW hydraulic grinder for the rapid multiple wheel grinding of parts, which because of the wide spacing of the sur-



Landis Tool Co.'s 16 in. by 40 in. type IW hydraulic grinder

faces involved require that the grinding wheels be mounted between the wheel spindle bearings. A typical operation would be the grinding of several of the main bearings and the outside diameters of the flange of a crankshaft.

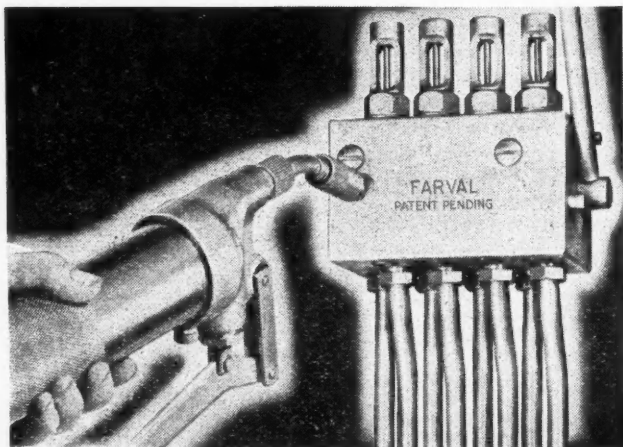
Operation is automatic once the grinding cycle has been started. One of the major features is the work loading and unloading device.

Farval DX Multiple Measuring Valve

A new system for lubricating small machines from a single grease inlet has been developed by The Farval Corp. of Cleveland.

This new unit, the DX multiple measuring valve, combines a single inlet port with two to eight outlets per block. As many valve blocks as may be needed to lubricate all bearings on a machine can be installed and connected in series.

Positive, pressure lubrication of every bearing is accomplished by connecting a conventional type of hand or power grease gun to the grease nipple at the

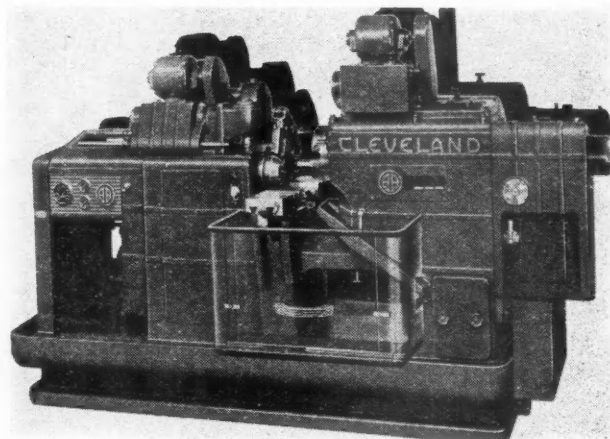


Farval DX multiple measuring valve.

inlet port. In one position of the rotary valve handle at the right side of the block, the valve pistons are moved by pressure built up by the gun, delivering lubricant to bearings through one set of valve outlets. When the valve handle is turned to the opposite position, lubricant pressure moves the valve pistons in the opposite direction to deliver lubricant to the other set of outlets.

Cleveland Single-Spindle Automatic, Model 2 AA

Cleveland Automatic Machine Co., Cleveland, Ohio, recently brought out its Model 2 AA single-spindle automatic, a machine adapted for the quantity production of a wide variety of small parts. It has a welded pan and a one-piece bed, with large openings in the pan. The spindle head is of the all-gear type, with shaved gears and anti-friction bearings. Operating features of the machine include fast indexing, universal camming, infinitely variable positive tool



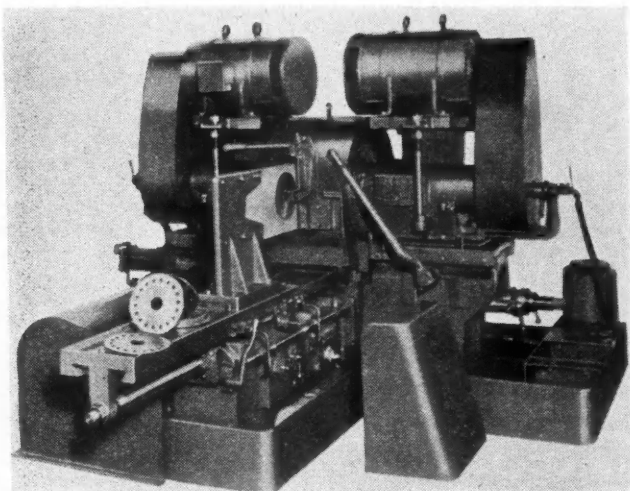
Cleveland single-spindle automatic.

feed, and long stock feed. Double chucking and stock-feeding in one cycle is available. The rigid six-hole turret permits heavy feeds. An anti-friction mounting of the stock-feed tube permits operation at high speeds.

New Foreign-Built Machines Introduced by George Scherr

Three foreign-built machine tools being introduced into this country by George Scherr Co., New York, are the Koepfer full automatic gear hobber, Niles gear tooth grinder, and the Tornos high-speed automatic.

The Swiss-built Tornos high-speed automatics are made in eight different sizes, ranging from 5/32-in to 1 3/16-in. spindle bore. The principle of construction employed in the Tornos differs considerably from the conventional American type of automatic screw machine. First obvious difference is in the headstock, which on the Tornos feeds longitudinally on the bed for a distance which corresponds to the length of the work. The rapidly revolving bar is held by collet chucks in the hollow spindle of the headstock and is fed forward toward the tools, guided by a bushing on



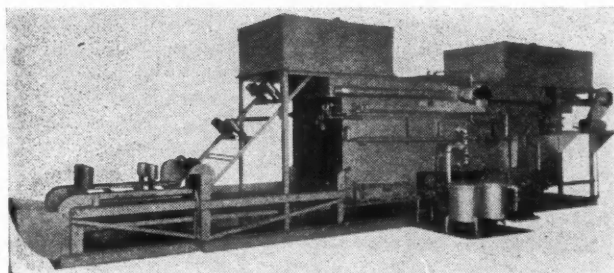
One of the new double spindle grinders built by the Gardner Machine Co., Beloit, Wis. The 120A-26 in. Gardner machine of this type will grind automobile clutch spring discs measuring $9\frac{3}{8}$ in. O.D. by $\frac{1}{8}$ in. thick, made of high carbon spring steel and ground on the two parallel faces. Each disc is carried between the abrasive members in a blade-type fixture mounted on an hydraulically-operated knee. The knee oscillates automatically, thus permitting the taking of several passes or cuts while the grinding heads are hydraulically closed in upon the work. The piece is held loosely enough to permit spinning during the grinding operation.

the outer end of the spindle. From two to five turning tools are arranged radially around the bar.

In order to turn different diameters, shoulders, tapers, or generate forms of any kind, the tools move in or out by cam motion in exact relation to the longitudinal feed of the bar stock. Accuracy limit within 0.0002 in. can be maintained with these machines.

The Niles tooth grinder is a newly developed design said to be particularly suitable for shops where a variety of work must be handled, such as spur gears, helical gears, and spiral gears. No master gears or racks, base circles, formers, pantographs, etc., are required. The amount dressed off the wheel is compensated for automatically in the diameter setting. The machine is made in four sizes, 12 in., 20 in. 32 in. and 48 in. capacity.

The Koepfer full automatic gear hobber with magazine feed cuts fully automatically small pinions and gears of 80 to 25 D.P. Work integral with the shaft is placed in the magazine and automatically cut and ejected. One operator can run 6 to 10 machines. A smaller size Koepfer hobbing machine is semi-auto-



Automatic degreasing machine built by G. S. Blakeslee & Co.

matic in operation and particularly suitable for pinion and gears of the highest precision. This smaller machine has a capacity from $\frac{1}{8}$ in. to 2 in. diameter, 170 D.P. to 25 D.P.

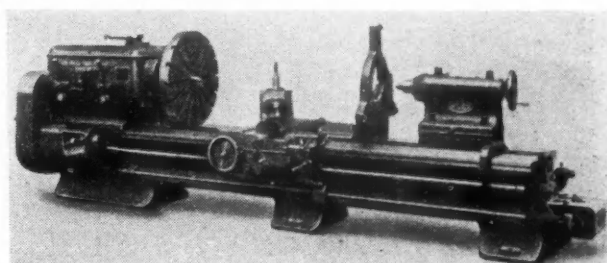
Blakeslee Automatic Degreasing Machine

The Blakeslee automatic degreasing machine illustrated herewith is of the vapor-spray-vapor type and is equipped with a double strand cross rod conveyor with special fixtures for holding the various size containers. Double, tandem filters are incorporated in the design for continually purifying the solvent free from the metal dust, dirt and solubles removed from the work.

The fixtures open and close automatically. The only attention required from the operator is the placing of containers on the fixture, after which they pass through the vapor-solvent sprays and are given a final vapor rinse before leaving the machine. The parts are then discharged automatically on to an auxiliary conveyor, carrying them to the next operation.

New 30 in. Lathe Built by Niles

An improved 30-in. "Time Saver" lathe has been announced by the Niles Tool Works Division of the General Machinery Corp., Hamilton, Ohio. It has 48 feeds ranging from $1/64$ in. to 1 in., and speeds ranging from 3.94 to 232 r.p.m.



The 30-in. "Time Saver" Lathe which is made by Niles Tool Works

All headstock gears of this machine are hardened and ground. Drive is through multiple V-belts by a motor mounted on an adjustable base and located in the rear of the machine. The spindle and all shafts are completely equipped with anti-friction bearings.

Ball Bearing Pillow Blocks

Two entirely new series of ball bearing pillow blocks were announced recently by the Ahlberg Bearing Co., Chicago. They were developed to meet a demand for a light duty ball bearing unit, one which could be used in equipment where cost heretofore prohibited the use of an anti-friction bearing.

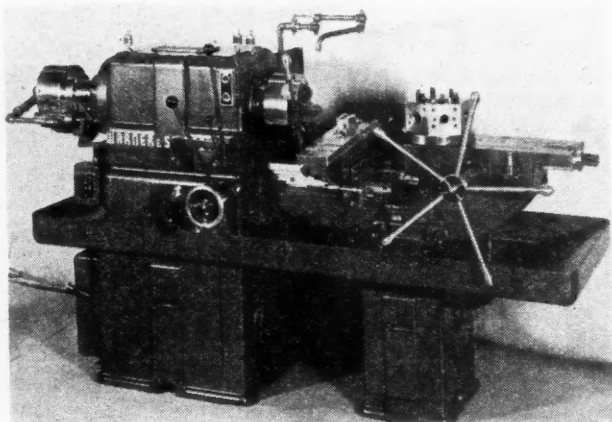
One type, known as the "ED" series, is a compact unit containing a precision type ball bearing, seals

made of neoprene, and a one-piece die-cast housing. It is available in shaft sizes from $\frac{1}{2}$ in. to $1 \frac{3}{16}$ in.

The other series, called the "EDR", is an improved, noiseless type of ball bearing pillow block. The precision type bearing is completely insulated from the housing by a cushion of neoprene. Housing and seals are the same as those of the "ED" series.

New Turret Lathe Designed Especially for Brass Work

Designed not only for high-speed cutting but for high-speed operation, an entirely new turret lathe ($16\frac{3}{4}$ in. swing) designed especially for brass work by the Warner & Swasey Co. has a simple, direct, two-speed drive and an electrically operated mechan-



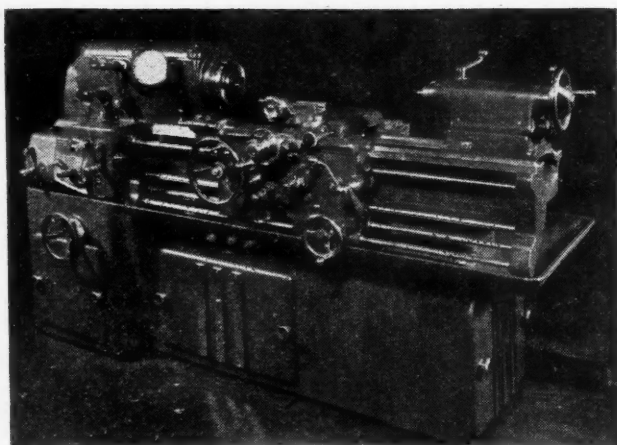
Warner & Swasey turret lathe designed for brass work.

ical brake. The turret slide and saddle are completely guarded to keep chips out of vital operating parts.

One of the features is automatic control of the two spindle speeds and reverse which is operated by the movement and indexing of the hexagon turret.

Tool Maker's Lathe With New All-Electric, Adjustable-Speed Drive

A 12 in. by 30 in. tool maker's lathe powered with a recently developed all-electric, alternating current,



Monarch Machine Tool Co.'s new 12 in. by 30 in. tool maker's lathe.

Baker Brothers, Inc., Toledo, Ohio, designed this new hydraulic feed unit which is adapted to single spindle and multiple spindle drilling, boring, reaming, counter-boring, hollow milling, chamfering, and facing operations. Feature of the unit is the use of a new design of variable delivery pump.



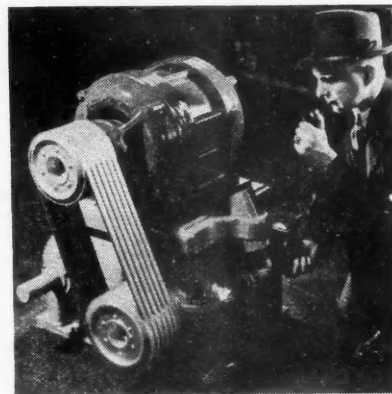
adjustable-speed drive is the newest addition to the line of machines manufactured by the Monarch Machine Tool Co. The 100 to one spindle speed power unit on this machine is entirely self-contained, being mounted inside the cabinet base. Drive is through a new type flat belt.

Two ranges of spindle speeds from 15 to 1500 r.p.m. are provided by means of a back-geared unit on the spindle. This range may be varied to suit the user's requirements.

New Base for Allis-Chalmers Speed Changers

The line of "Vari-Pitch" speed changer units, recently brought out by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., now includes 12 sizes that will handle loads up to 75 hp. with variable ratios of 3:1. For

The new base for Allis - Chalmers speed changer unit is designed for compact installations



use with all these sizes the company has developed also a new base especially designed for compact installations where floor space is at a premium.

Shearing and Die Assembling Machine

For facilitating tool room work in shearing punches in dies the Producto Machine Co., Bridgeport, Conn., has developed a new shearing and die assembling machine. Construction of this machine also facilitates the lining up and assembly of punches and dies by suspending the punch and punch holder in any desired position.

A large size ram is movable through a handwheel, worm and worm gear, which will generate a power or pressure equal to 30 tons. The gear reduction on the ram has a ratio of 34 to 1, and the handwheel is 25 in.

You can't tell the cost of steel until...

... after a reasonable quantity of steel sheets have been put through forming and finishing operations ... after all time losses and rejects are accounted for ... then, and then only, can you tell how much your steel is costing you.

Can this cost be reduced? You may think no saving can be made. But why not make sure? Put this question to an Inland metallurgist, for it is his business to know the answer or find it for you quickly. In a surprising number of cases Inland Men are able to find new economies or ways to improve the result.

You will like the friendly way in which your nearest Inland Office will co-operate whether you need steel or information about it.

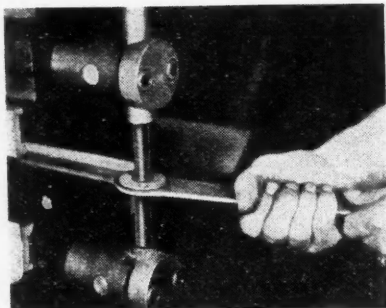
INLAND STEEL CO.

38 S. Dearborn St., CHICAGO • District Offices: MILWAUKEE • DETROIT • ST. PAUL • ST. LOUIS • KANSAS CITY • CINCINNATI

SHEETS STRIP TIN PLATE BARS PLATES FLOOR PLATES STRUCTURALS PILING RAILS TRACK ACCESSORIES REINFORCING BARS

in diameter. A separate handwheel permits the quick movement up and down of the ram for adjustment. The ram can be stopped in any desired position for convenience when the machine is used for lining up and assembling of punch and die.

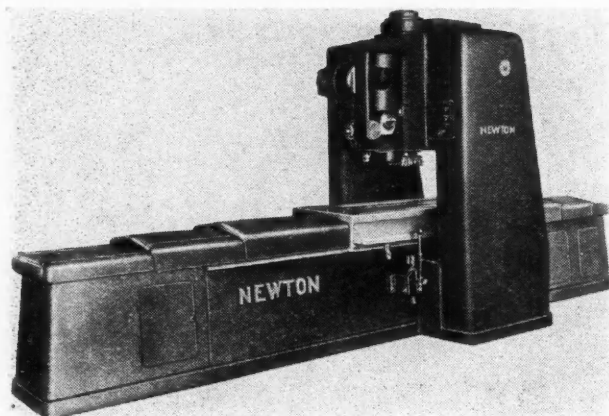
New Spot Welding Tip Dresser



This new tool re-machines both upper and lower spot welding tips to their correct profile "on the job" without necessitating the removal of the tips from their water-cooled holders. P. R. Mallory & Co., Inc., Indianapolis, Ind., manufacturer of the new dresser, states that it saves considerable down time and insures the use of uniform contact area with the work.

Newton Straight Line Type "Mill-N-Shaver"

One of the newest products of the Consolidated Machine Tool Corp., Rochester, N. Y., is the vertical spindle model of Newton straight line type of "Mill-N-Shaver," illustrated herewith. The "Mill-N-Shaver"

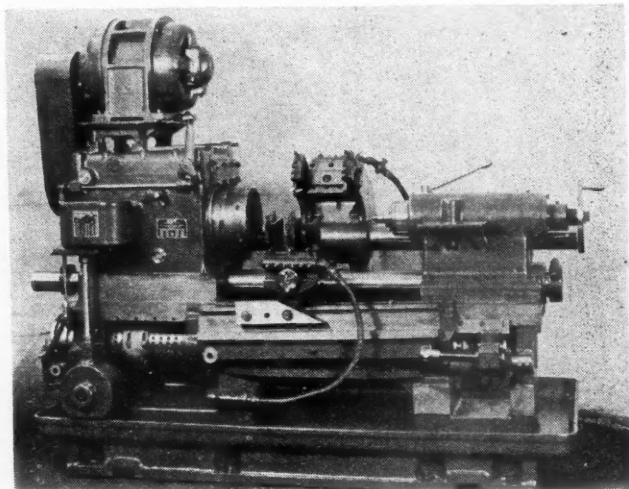


Newton straight line type "Mill-N-Shaver" built by Consolidated Machine Tool Corp.

may be arranged with one or more unit milling heads and the same number or less of shaving heads, depending on the requirements of the work. The heads may be arranged horizontally or vertically or placed at any angle to suit the surface to be finished.

Automatic-Feed Surface Grinder

Model No. 2 automatic-feed surface grinder built by Reid Brothers Co., Inc., Beverly, Mass., will grind work up to 18 in. long, 6 in. wide, and 11 in. high. Centralized control has been effected by placing the handwheel for elevating of the spindle head at the right of the table handwheels, instead of at the top of the column, as formerly placed.



The new Jones & Lamson 16-in. Fay automatic lathe. This is a heavy duty machine designed to take full advantage of modern hard alloy cutting tools and will transmit power in excess of 50 hp. It is provided with an extra large low chip pan and is available in five standard lengths, with a capacity between centers of 23, 35, 53, 71 and 89 in. respectively. It will swing 12½ in. over the carriage and 17½ in. over the center bar and back bar and has eight spindle speeds with a standard set of change gears ranging from 28 to 180 r.p.m.

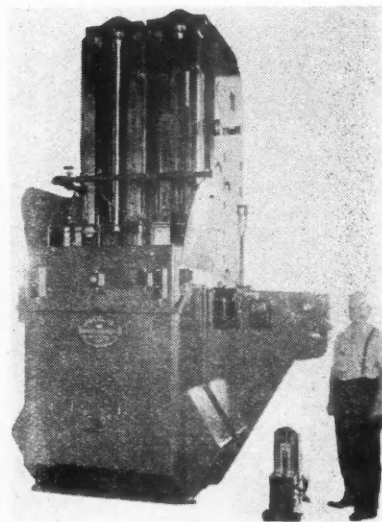
The spindle is the cartridge type and can be interchanged or removed with a minimum of labor. Extreme care has been taken in protecting all bearing surfaces from abrasive dust.

"American" Dual-Ram Surface-Broaching Machine

The machine illustrated herewith was built by the American Broach & Machine Co., Ann Arbor, Mich., for contour-broaching a forging of SAE 3120 steel. The forging is broached on practically all surfaces, four passes being required to complete the operation, and the finish obtained is commercially acceptable.

Moving cylinders or rams slide in hardened and ground, box-type ways in a massive column of fabricated steel, on integrally-cast guides extending the full length. Lubrication is by pressure and automatic. Dual receding work tables are indexed alternately by a modified Geneva mechanism which provides for gradual acceleration to midstroke and gradual deceleration from this point to the end of the stroke, to provide smooth and shockless indexing. The two

(Turn to Page 393, Please)



"American" surface-broaching machine

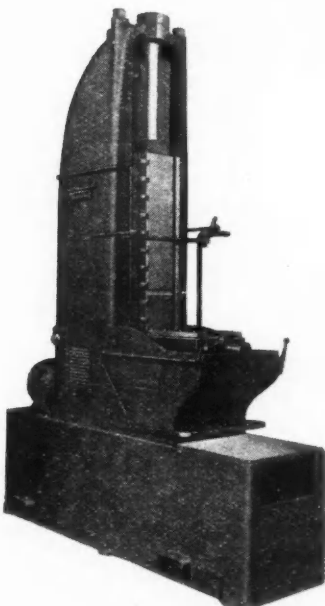
**THESE ODD SHAPES
ARE NO HINDRANCE
TO HIGH PRODUCTION**



A SYMBOL OF A DEFINITE STANDARD
OF WORTH



B-176



Odd shaped parts are sometimes difficult to broach rapidly, because they're awkward to handle and hard to hold securely in the fixture. But here's a case where the production of odd shaped steering knuckle support arms exceeds by about 100% the original requirements.

The equipment consists of a CINCINNATI No. 2-36 Single Ram Vertical Hydro-Broach, having a receding table, and equipped with a simple air operated fixture. Fatigue is reduced to a minimum by the fixture arrangement, while the table retraction is sufficient to allow plenty of clearance to load and unload the part.

Job data:

Machine:
Part name:
Operation:
Material:
Stock Removal:
Production:

No. 2-36 Single Ram Vertical Broach
Steering Knuckle Support Arm
Finish Broach Inside Yoke Faces
Steel Forging
3/32"
254 per hour

Send us blue prints of your surface-finished production parts. Chances are that we can reduce costs for you and improve quality.

P.S. Would you like to have a catalog (No. M-834) covering our Single Ram Vertical Hydro-Broach Machines? A copy is yours for the asking.

THE CINCINNATI MILLING MACHINE CO.
Cincinnati, Ohio, U. S. A.

NEWS OF THE INDUSTRY

Finance Executives Discuss Competition of Local Banks

Support for Positive Legislative Program Urged at NASFC Meeting in New York

War clouds, both European and domestic, hung over meetings of sales finance executives, Sept. 14 and 15, in New York, as speakers discussed: 1. Probable effects of the war upon American car sales and other retail business, and 2. Growing competition in retail finance from local banks throughout the country. Sponsored by the National Association of Sales Finance Companies, the convention was attended by many non-member companies for the first time in the association's history.

To Paul G. Hoffman, president, Studebaker Corp., the present conflict across the Atlantic is a warning to American business men to resist any and all efforts by government to control business in the competitive area by a bureaucratic domination of business management. He pointed out in his speech at the convention that the war is a conflict of the philosophies of free enterprise on the one hand, and feudalism on the other. It is the job of government, he said, to "crack down on monopolistic practices, and to protect business men against unfair competitive practices." He held that in the field of monopoly some measure of control is necessary; in the competitive field the governmental function is one of policing.

Dr. Jules I. Bogen, editor of the *New York Journal of Commerce*, warned business men to beware of the "boomerang of war-time hysteria" in planning ahead in their capacity as business executives. He pointed out that many of the war-time profits during the World War had been wiped out by the succeeding depression, and many businesses had failed because they relied too much on war-time profits to continue indefinitely.

He expects the present war, even if it is of short duration, to cripple world credits for generations to come. Several banking and financial authorities warned that "war baby" stocks would prove to be "war orphans."

On the domestic "front," retiring-President A. D. Weller of the NASFC

led the convention into a broad discussion of the new competition of banks. He and other speakers traced the competition to: 1. Failure of many finance companies to extend enough help to service dealers and car owners; 2. Failure of many finance companies to keep in touch with their customers after the automobile had been paid for, and extending to them financing for maintenance and repairs, and in other fields of loans; and 3. The belief on the part of banks that the financing business was far more profitable than it really is.

In an extensive forum of the automotive division, finance executives agreed that local banks had entered the sales finance business in recent years because of the diminishing profits in other lines of banking activity. However, speakers from coast to coast and from Canada reported that many banks had discovered that:

1. After banks had learned enough about the complexities involved in retail sales financing, many had retired from the field.

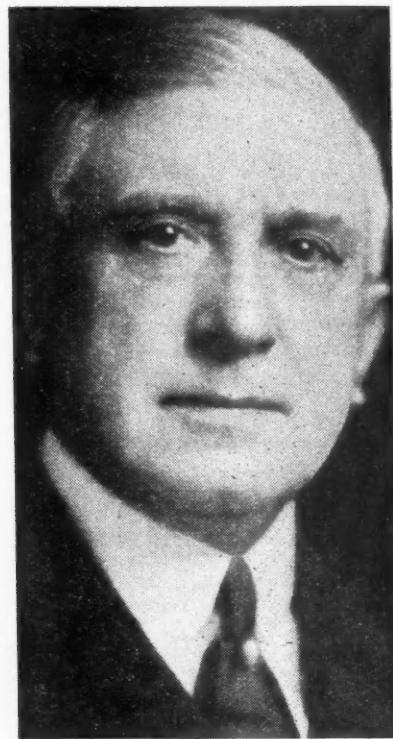
2. In general banks took the cream of the business, doing business with their own customers whose credit had been fully established.

3. Some banks make a practice of shifting customers from one dealer to another.

(Turn to page 399, please)

Index of Machine Tool Orders 206.5 in August

The National Machine Tool Builders' Association reports that its index of machine tool orders stood at 206.5 for August, holding above 200 for the fourth successive month. A considerable slackening of foreign orders received during the month is said by the association to have contributed to the 10 per cent drop in volume of new business as compared to July. The association also observes that domestic orders were almost equal to July volume indicating a strengthening demand here.



Charles M. Schwab

Death came peacefully Sept. 18 to Charles M. Schwab, one of the most vigorous and energetic industrialists in American history. He had not been well during recent years, but worked hard on management problems of Bethlehem Steel Co., which he had organized about 35 years ago when he "retired" as president of the United States Steel Corp.

Through a banking syndicate he became interested in the Stutz Motor Car Co. in 1920. Within a year the company had entered its most successful era under the presidency of Frederick E. Moscovics, whom Mr. Schwab chose to head the concern.

The steel magnate made it a point to attend all the company's sales conventions, inspired the dealers with his sales talks, and upon occasion played the piano for their entertainment.

But alloy steels was Mr. Schwab's great business passion. Not long ago he told this reporter for *AUTOMOTIVE INDUSTRIES* that we all would look back, within a few decades, to the "horrible waste of weight in all transportation. Alloy steels have been known a long time, but no one knows enough about

(Turn to page 399, please)

"40% FASTER- 20% EASIER"

WITH THE TORRINGTON NEEDLE BEARING

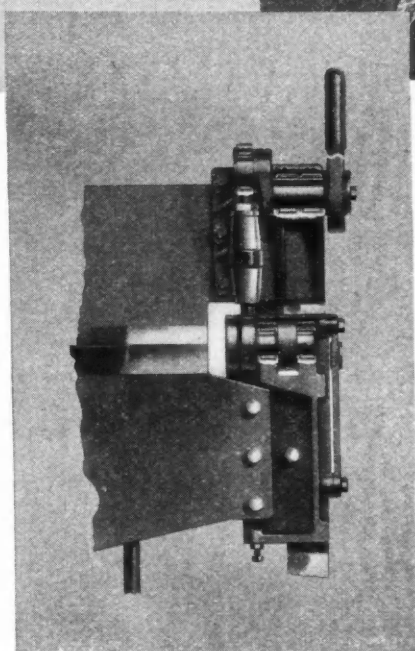


The Whitney-Jensen combination bending brake in use. Torrington Needle Bearings have increased the ease and speed of operation.

TORRINGTON Needle Bearings are standard equipment now on all Whitney-Jensen combination bending brakes—because experience has proved that their operation is far faster and easier when Needle Bearings are used.

Whitney Metal Tool Company, manufacturer of the brakes, tested the Needle Bearing in comparison with bushings on apron supports and eccentric shafts. Here's what their engineers report:

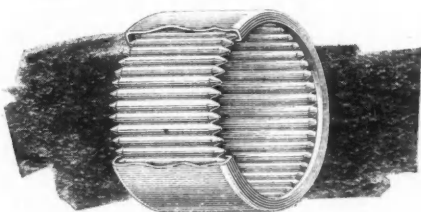
"The force necessary to swing the apron when making a bend was decreased by 12 to 14%. The force required to pull down the upper jaw when pressing seams to flatten them out after



View showing the location of the Torrington Needle Bearings on the bending brake. Note the simplicity of housing design.

Translate these remarkable operating improvements into terms of your own products. Consider that the Needle Bearing gives you anti-friction operation, with high load capacity, in a low-cost, compact unit that is easily installed, and frequently occupies no more space than a plain bushing. Let the Torrington Engineering Department show you how easily your product designs can be adapted to incorporate the advantages of this unusual bearing.

For further information write for Catalog No. 7. For Needle Bearings to be used in heavier service, request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.



bending was decreased by 32%, and the force necessary to release the clamping handle from the over-center position was decreased by 90%."

Whitney customers were quick to appreciate the advantages of the Needle Bearing. One customer reports that his production has been doubled by the Needle-Bearing-equipped brakes. Other users of bushing-equipped brakes have had Needle Bearings installed at their

own expense—in order to gain these advantages of improved operation. "In general," says the Whitney Metal Tool Company, "the Needle Bearing brake is 40% faster than the same brake equipped with plain bearings and is 20% easier on the operator."

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings

Branch Offices in all Principal Cities

TORRINGTON NEEDLE BEARING

Steel Activity Stimulated by Heavy Automotive Buying

Last Quarter Prices to Remain Unaltered Although Increases Are Intimated for '40

Specifications from automobile manufacturers and parts makers have been coming to steel mills at a rate which recently prompted some of the smaller producers to announce that their output during the year's remaining three months would be absorbed by orders now on their books. The rise in the rate of ingot operations is generally attributed to heavier tonnage of sheets and strip steel as well as of hot-rolled and cold-finished carbon and alloy bars called for by the impending assemblies of automobile manufacturers. Production schedules of rolling and finishing units are being stepped up to keep pace with customers' requirements being graduated so as to allow for deliveries of semi-finished material to attain the volume of current demand.

Living up to its traditional feast or famine psychology, the steel market, which in midsummer was in the doldrums, is already lending a willing ear to tales of approaching scarcity of supplies. Not only is normal capacity of continuous mills in excess of any demand now in sight, but recent announcements of leading producers show that, when tonnage orders permit of uninterrupted production, without the necessity of too frequent change-overs, such as is the case now, output can be speeded up beyond earlier expectations. Transient neck-of-the-bottle conditions may ensue as the result of inadequate supplies of the primary forms of steel, but for the time being apprehension on this score is unfounded.

The not unexpected announcement that prices would remain unaltered over the year's remaining quarter, was coupled with intimations by some of the steel producers that first quarter 1940 prices would be subject to upward revision. This will make for a certain amount of congestion on steel mills' order books during the year's final period as many of the smaller buyers will want to anticipate advances. What the attitude of the larger steel buyers will be, depends upon how business in general will shape up during the next few months. Most of the large automobile manufacturers are reported to have covered their pig iron requirements for the next quarter before the \$2 per ton advance was announced.

Announcement that the British Ministry of Supply had fixed the price of tin at the equivalent of 39½ cents a pound caused American consumers to utter a sigh of relief. At the same time the International Tin Committee raised output quotas from 80 to 100 per cent of the basic tonnage. The market here continues strictly nominal, some business in futures being reported at fairly reasonable prices, but spot

Straits tin is still unavailable at a price in keeping with that marked up by the British officials. Some tin for account of an automotive consumer is coming in direct from Singapore by way of a Pacific Coast port.—W. C. H.

CALENDAR

Conventions and Meetings

- SAE National Aircraft Production Meeting, Hotel Biltmore, Los Angeles, Calif.Oct. 5-7
- American Society of Tool Engineers Meeting, ClevelandOct. 6-7
- SAE Annual Dinner, Hotel Pennsylvania, New York, N. Y.Oct. 16
- American Welding Society, Annual Meeting, ChicagoOct. 22-27
- American Trucking Association, Annual Meeting, ChicagoOct. 23-24
- SAE Transportation & Maintenance Meeting, Coronado Hotel, St. Louis, Mo.Oct. 26-27
- SAE Fuels & Lubricants Meeting, Mayo Hotel, Tulsa, Okla.Nov. 2-3
- American Petroleum Institute, Annual Meeting, ChicagoNov. 13-17
- National Independent Traffic League, Annual Meeting, ChicagoNov. 23-24
- Motor & Equipment Wholesalers Association, Annual Convention, ChicagoDec. 8-9
- SAE Annual Meeting & Engineering Display, Book-Cadillac Hotel, DetroitJan. 15-19, 1940

Shows at Home and Abroad

- Great Britain, London, Automobile ShowOct. 12-21
- Rochester, N. Y., Automobile Show, Oct. 14-21
- Toronto, Ont., Automobile Show, Oct. 14-28
- Indianapolis, Ind., Automobile Show, Oct. 15-21
- Los Angeles, Cal., Automobile Show, Oct. 15-22
- National Automobile Show, New York, Oct. 15-22
- Newark, N. J., Automobile Show, Oct. 21-28
- Baltimore, Md., Automobile Show, Oct. 21-28
- Buffalo, N. Y., Automobile Show, Oct. 21-28
- Detroit, Mich., Automobile Show, Oct. 21-28
- Milwaukee, Wis., Automobile Show, Oct. 21-28
- Pittsburgh, Pa., Automobile Show, Oct. 21-28
- St. Louis, Mo., Automobile Show, Oct. 22-28
- National Metals Congress and Exposition, ChicagoOct. 23-27
- Philadelphia, Pa., Automobile Show, Oct. 26-Nov. 1
- International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6
- Great Britain, London, Commercial Automobile Transportation Show, Nov. 2-11
- San Francisco, Cal., Automobile Show, Nov. 3-9
- Chicago, Ill., Automobile ShowNov. 4-12
- National Truck Show, ChicagoNov. 8-16
- Great Britain, Glasgow, Scotch Automobile ShowNov. 10-18
- Butte, Mont., Automobile ShowDec. 4-5
- Automotive Service Industries Show, Navy Pier, ChicagoDec. 11-16



W. J. Cameron

—well known for his inspirational talks on the Ford Sunday Evening Hour broadcasts, as he addressed the annual meeting of the company's National Merit Club.

IN OTHER WORDS

In our Sept. 1 issue, and again in our issue of Sept. 15, we spoke of the special language, or slang, which has grown up around the scores of specialized vocations in the automotive field. We mentioned that we would like to collect specimens, define them and publish them for your, and our own, amusement and education.

Frank E. Watts, automotive engineering consultant of Detroit, and former chief engineer with Hupp Motor Car Co., is the leading contributor to our embryonic collection. Mr. Watts offers two terms which were in use at the Hupp plant. The terms:

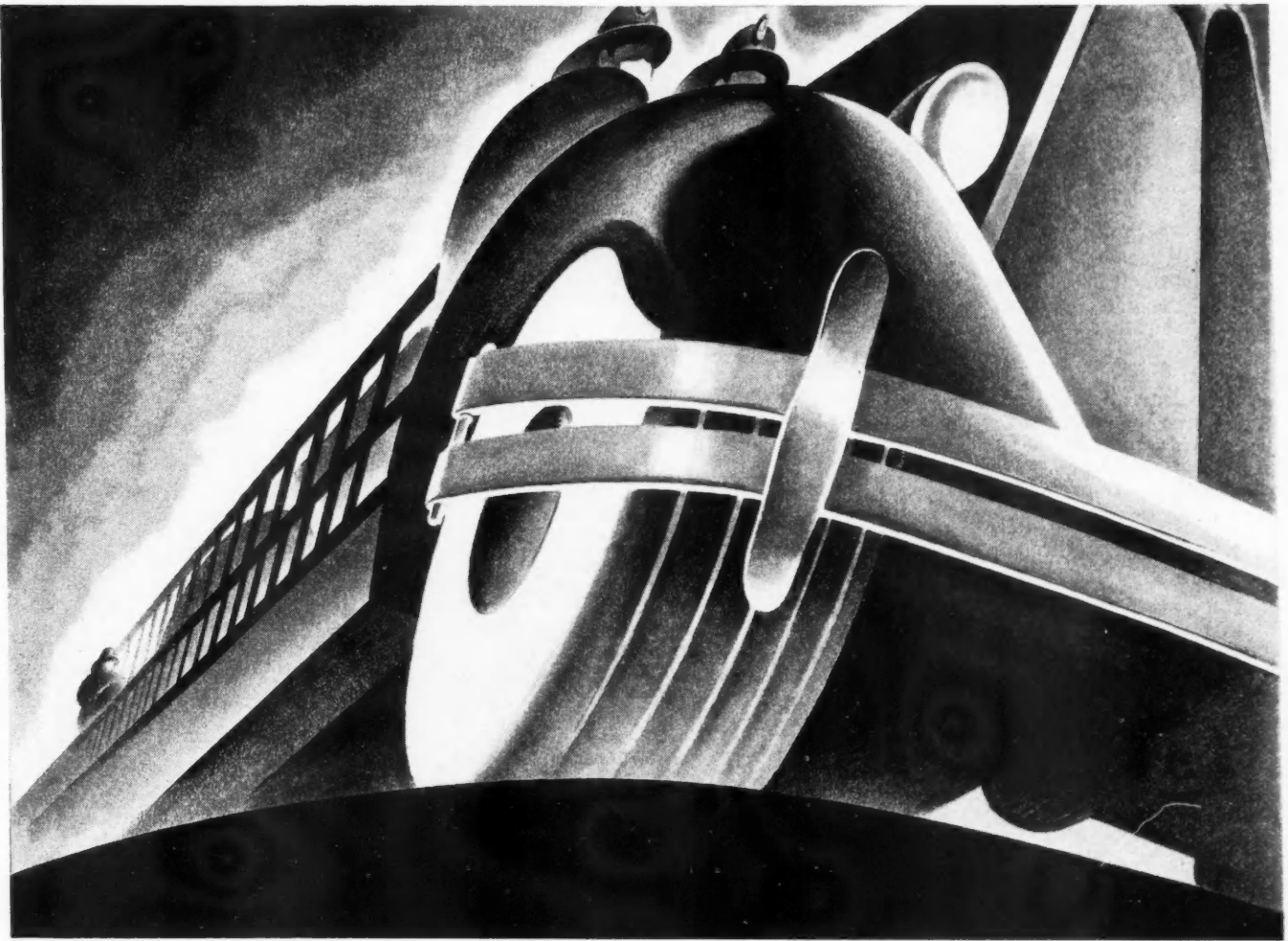
Frog—Used to designate the stamping which formed the radiator shell. So named because of its shape which, stamped as it was with a hole on either side for the headlights, strongly resembled that creature.

Swamp Angel—Term applied to a machine for lapping in pistons. During the Civil War this was the nickname of a famous howitzer.

Martin Berlyn, of Dominion Engineering Works, Ltd., Montreal, sent in as his contribution:

Built-in Headwind—Term applied to characteristics of a poorly streamlined airplane.

There are undoubtedly many unique terms used in your own branch of the industry. Your contribution will be warmly welcomed. Remember, a penny postal will do the trick.



SPECIFYING FOR DEPENDABILITY PLUS

Failure in the motor crankshaft of a piece of fire fighting equipment may mean the difference between a small fire and a large one, even between life and death.

That is why a leading manufacturer chooses Chrome-Molybdenum (SAE 4140) steel for this vital part. It has the requisite strength and toughness. And, most important, it has good fatigue strength to meet the continually alternating loads which are characteristic of crankshaft service.

Furthermore, the uniform response of this steel to

heat treatment assures the consistent qualities essential in volume production, while its comparative inexpensiveness and ready machineability in the heat treated condition keep costs down.

Re-checking your own specifications may disclose opportunities for increasing dependability at little or no added cost by the use of Molybdenum steels. Our book, "Molybdenum in Steel", will help you find them. It is sent free to interested production executives and engineers on request.

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State Statutes Build Serious Barriers to Interstate Commerce

Preliminary Marketing Laws Survey Reveals Discriminatory Legislation

The growing tendency of state legislation and policy to create serious barriers to the free flow of commerce between the states is becoming of prime concern to all industry, so much that retaliatory and discriminatory state laws threatening the existence of a free national market in the United States are the subject of a marketing laws survey conducted by the Works Progress Administration. That the states themselves are recognizing the seriousness of the situation is demonstrated by the fact that the Council of State Governments sponsored in Chicago last April a National Conference on Interstate Trade Barriers. For use by the Conference the WPA marketing laws survey staff prepared a publication consisting, for the most part, of comparative charts furnishing typical examples of those state laws which, on their face or in operation and effect, tend to obstruct the marketing of goods in interstate trade. Copies of this publication, listed as "Comparative Charts of State Statutes Illustrating Barriers to Trade Between States," are now available from the Superintendent of Documents, Washington, D. C., for 25 cents.

A brief analysis of the charts given in the publication indicates that motor vehicle laws present perhaps the greatest barriers to trade between states—even though only the most important barrier aspects were selected for the analysis, as it was not practicable to indicate all the laws or even their major provisions affecting interstate motor transportation. The barriers, in favor of domestic vehicles, are not always manifest on the face of the statutes, but, it was said, operate as a cumulative burden on vehicles which must pass through several states, paying fees in each. Such burdens, when pyramided against a single vehicle, constitute a real handicap and interference with motor transportation.

Seven states, it was pointed out, grant no reciprocity to commercial vehicles of other states—and only nine states grant complete reciprocity as to all fees. The benefits of reciprocity decrease as the distance between the reciprocating states increases—and the statutes do not reveal to what extent reciprocity is actually put into practice.

Trucks entering a state not subject to reciprocity are often subjected to heavy taxes—taxes which usually increase sharply with the size of the truck. While in some states it is possible for interstate trucks to pay a mileage tax in lieu of registration charges, these are often for interstate than for intrastate vehicles.

Interstate transportation is also subject to gross-receipt taxes in eight states, apportioned on the ratio which mileage within the state bears to total miles of transportation. These vary from one-half of one per cent in Montana to six per cent in North Carolina.

While some 14 states indicated in the report have enacted mileage taxes calculated either on the basis of ton-miles or on a graduated mileage basis for trucks of varying weights, it should be stated, in fairness, that these apply equally to intrastate and interstate commerce and cannot be said to be a distinct burden on interstate commerce. It would seem, however, according to the report, that these taxes do discourage both types of operations.

(Turn to page 400, please)

CES and ASTE Will Hold Cleveland Meetings

With the exception of two, the participating societies in the canceled Machine Tool Congress have also cancelled their individual programs and meetings. The Cleveland Engineering Society will continue with its meeting planned for Oct. 10; the American Society of Tool Engineers has decided to go on with its semi-annual meeting with, however, a rearrangement of dates. Originally scheduled for Oct. 5-6, the meeting will be held Oct. 6-7.

While the American Foundrymen's Association program has been can-

celled, the Northeastern Ohio chapter will hold its regular meeting on Oct. 12.

Program for the ASTE meeting is as follows:

Friday, Oct. 6

7 A. M. to 9 A. M.—REGISTRATION. Mezzanine Floor, Hotel Statler.

9 A. M. to 5 P. M.—PLANT VISITS. See appended schedule.

6.30 P. M.—SEMI-ANNUAL DINNER AND MEETING. Grand Ball Room, Hotel.

PROGRAM

Presiding: James R. Weaver, president A.S.T.E., director of equipment inspection, purchase, tests—Westinghouse Elec. & Mfg. Co.

"THE EFFECT OF THE DEVELOPMENT OF THE MACHINE ON EMPLOYMENT AND OUR STANDARD OF LIVING."

(Second Report of Committee)

John M. Younger, Chairman of A.S.T.E. Fact Finding Committee; Professor, Industrial Engineering, Ohio State University.

"ECONOMIC AND POLITICAL EFFECT OF THE DEVELOPMENT OF THE MACHINE."

Hon. Hamilton Fish, U. S. Congressman from New York.

Saturday, Oct. 7

10 A. M.—TECHNICAL SESSION. Euclid Ball Room, Hotel Statler.

"SYMPOSIUM ON BEARINGS"

Presiding: G. J. Hawkey, chairman, Cleveland Chapter, A.S.T.E., president, The Cleveland Duplex Machinery Co., Inc.

"APPLICATION AND USE OF ANTI-FRICTION BEARINGS AS APPLIED TO MACHINE TOOLS."

Stanley R. Thomas, Chief Engineer, Bantam Bearings Corp.

"APPLICATION AND USE OF PLAIN BEARINGS AS APPLIED TO MACHINE TOOLS."

Eugene Bouton, Supv. Time Study, J. E. Case Tractor Works.

"BEARINGS—THEIR USE AND MISUSE." Karl L. Herman, Engineer, South Bend, Indiana.

DISCUSSION:

S. L. Crawshaw, Application Engineer, Westinghouse Elec. & Mfg. Co., Nuttall Works.

SCHEDULE OF PLANT VISITS

The Acme Machinery Co.

The Cleveland Graphite Bronze Co.

The Cleveland Twist Drill Co.

The National Acme Co.

The National Screw & Mfg. Co.

The Republic Steel Corp.

White Motor Co.

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES Manufacturing operations still hover around the 50 per cent capacity mark for the majority of producers. Deliveries of replacement equipment appear to be holding up fairly well.

TRUCKS Recent output rates are generally above anticipated schedules. Fourth quarter prospects are labelled "bright."

TRACTORS Production curtailed somewhat due probably to drought conditions prevailing in part of winter wheat country. One producer reports operations on an extensive scale but this is not true of others.

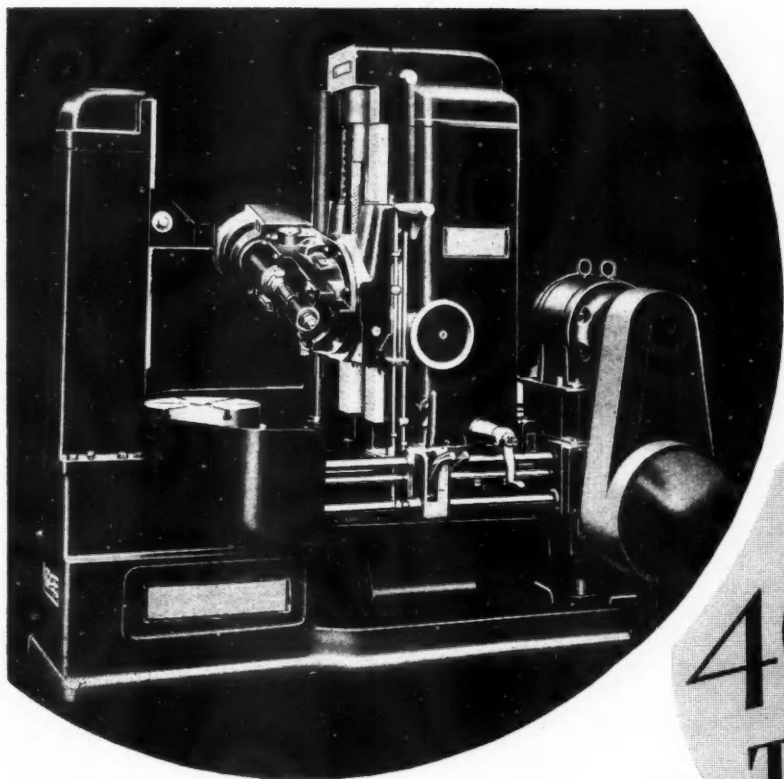
AUTOMOBILES Preliminary check of factory schedules indicates output for September of 180,000 units. Schedules of a number of major producers projected to the end of the year are said to show increases ranging from 20 to 25 per cent ahead of a year ago.

MARINE ENGINES The seasonal lull has set in, but builders of larger units report a growing backlog in government orders. A larger number of smaller Navy craft are being refitted.

AIRCRAFT ENGINES Output continues at a rapid rate.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

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New gear hobbing machine for spur and helical gears.

AUTOMOTIVE INDUSTRIES

Presents

40^{Years} of
TOOL PROGRESS

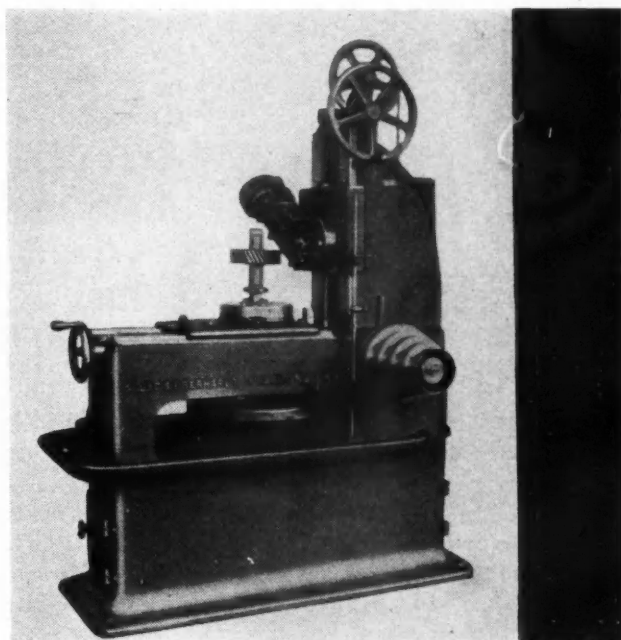
MACHINE

EVERYONE is aware of the vital rôle played by the machine tool industry in the development of the automobile. The fact sinks home with sharper impact, however, when it is pointed out that only 30 years ago it cost \$3,500 to produce a good automobile, whereas with the improved machine tool technique an automobile far superior to the best product of even 15 years ago is produced and sold at a profit today for approximately \$600. Pioneers—like Duryea, Haynes and Winton—who undertook to gain a foothold in the embryo industry, had to equip their factories with the standard machinery of the day. The “standard” machinery was similar in all respects but size to the equipment then employed in the production of stationary and marine engines. As public demand for automobiles increased, the machine tool builders began to give their attention to the design of special equipment. The record of advances made in machine tool design since that time reveals an impressive progression of refinements and innovations which has made possible the production of automotive parts with accuracy, interchangeability and economy that were undreamed of 40 years ago.

Methods of machining were regarded as precious secrets by the builders of horseless carriages and they carefully protected their processes from the prying eyes of competitors. The manufacturers saw danger in uniformity, believing that widespread adoption of the same fabricating practices would destroy desirable competition. Fortunately, within its history-packed

years of technical progress, the automotive industry has taken numerous steps in line with a constructive policy of sharing experience. Today that policy is recognized by many as a highly important factor contributing—among other beneficial results—to the development of greatly improved machine tools and allied equipment.

(Turn to page 346)



First automatic spur and helical gear hobbing machine developed in the United States and constructed about 1905.

40 Years of MACHINE TOOL PROGRESS

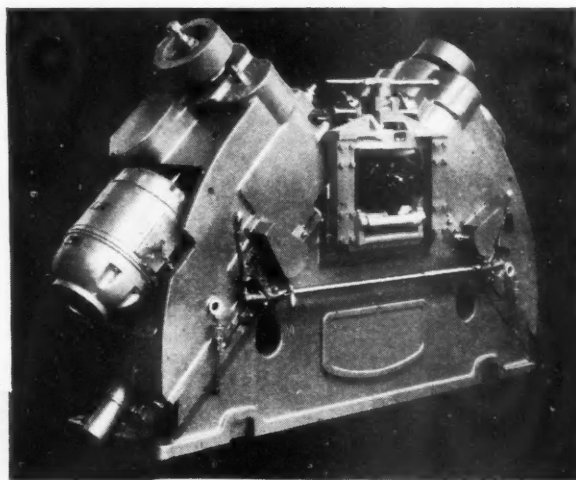
Why the relatively free exchange of manufacturing ideas has not brought about the predicted demise of competition is succinctly explained by F. C. Pyper of the Buick Motor Co. Mr. Pyper observes that there is presently as great a difference in the process of manufacturing various makes of motor vehicles as ever in the history of the industry. "The reason for these differences," he says, "is not necessarily due to a difference of opinion as to the efficiency of equipment. Nor is it because of an important diversion of thought as to methods of manufacture. The reason lies simply in the fact that selection of equipment must always be based upon such governing factors as volume requirements, necessary accuracy, financial investment involved, and existing equipment; in short, adaptability to requirements."

Many writers who discuss the developments in machine tools from the historical viewpoint mention the "rugged individualism" that characterized many builders of such equipment even in the early 1900's. While these manufacturers would construct on order a lathe, shaper, planer, milling machine or drill press, in other words most any type of machine known to them, they tended to concentrate on single outlets for their products, such as the railway shops, steel mills, powerplants and textile factories. However, several of the more alert producers saw a new, rich field in the rapidly growing automotive industry, and others were quick to follow their lead. After some years had passed a number of manufacturers of machine tools took a forward-looking step to strengthen their position as an industry and formed the National Machine Tool Builders' Association. In 1927 the association sponsored its first show and there followed at irregular intervals a succession of shows that stand out as milestones in the progress of this industry.

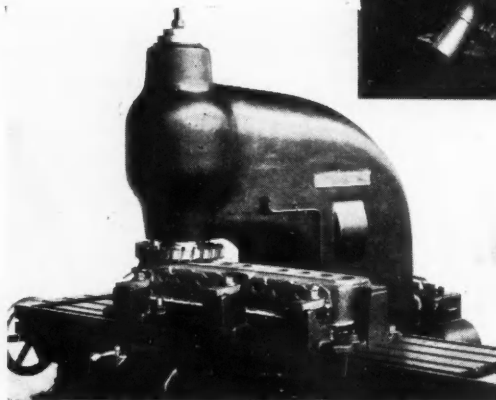
The 1939 show planned by the association, which has been canceled due to circumstances brought on by the outbreak of war in Europe, would have been the fourth since 1927. In this 12-year period alone, tremendous improvements have emerged. For instance, a visitor to the 1927 show would not have noticed much difference in most of the equipment displayed as compared with the machines of 15 or 20 years earlier. Controls were of the mechanical type requiring numerous levers and knobs. Systems for pressure greasing or central oiling

were not standard and machine exteriors were cluttered with plumbing. Some of the machines were belt driven, while on those that were motor-driven little consideration was given to the present practice of building motors integral with machines. Plain bearings were widely used, although anti-friction bearings had been employed with good results in other applications. Gears were very noisy. While high-speed steel tools could be handled by a number of the machines, there was evidence of new developments in alloys that warned of the imminence of obsolescence. With regard to tolerances, one writer observed that the machines "would hold work to 0.001 in. plus or minus, if carefully watched."

In 1929 the association sponsored another show. It would have been evident to the most casual observer at this exhibition that much constructive work had been done within the short span of two years. The eye immediately noticed that some attention had been



(Left) Early methods of milling employed a standard machine with a few simple clamping devices. The machines usually milled a single surface.



(Above) Special milling machine for extremely high production of engine blocks.

given to appearance. Closer inspection revealed that many builders had designed their equipment to handle high-speed cutting tools and in a few cases the machines were able to use cemented carbide tools, a new-comer in the field of cutting tools. Not only were electric drives and controls being used successfully, but hydraulic operation was employed on some units. Gears were very definitely improved.

By 1935 the industry had gone ahead literally by leaps and bounds. Throughout the lean years that followed 1929 there were "men at work" and the exhibition held that year disclosed not only many substantial improvements but a number of new types of machines. Many of the latter were inspired by the

(Turn to page 350, please)

AUTOMOTIVE PROGRESS

Remember — Pope Toledos at \$2800. — \$2500. Wintons — Pierce-Arrows for \$5000.—and, believe it or not, a \$2000. Ford (Model B)! Then think of today's cars—and today's car prices!

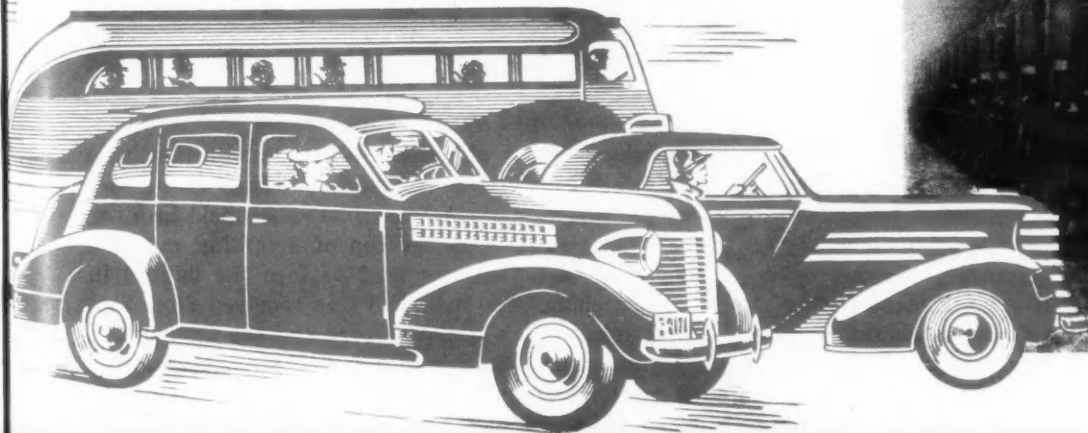
The first Bullard Mult-Au-Matics came into existence because the Automotive Industry visualized the making of today's cars at today's prices, and demanded a standard manufacturing machine tool of high productive capacity. Because Mult-Au-Matics met a created need, many thousands of them are at work today, through-

out all industry as well as in automotive plants, wherever versatility and low unit manufacturing cost are vitally needed.

The opportunities which inspired the first Bullard Mult-Au-Matic will come again—indeed they come again each year. Each time they inspire new Mult-Au-Matics with broader range, higher speeds, faster production, greater versatility. Each time Mult-Au-Matics meet the challenge and prove anew their right to stand as symbols of Automotive Progress.

THE BULLARD COMPANY, Bridgeport, Conn.

A few of over 450 Mult-Au-Matics which played their part in the manufacture of Ford cars as far back as 1920—indicative of the length of time Bullard has served the automotive industry.



AU-MATICS

40 Years of MACHINE TOOL PROGRESS

demands of the automobile manufacturers. The machines displayed at this show were built with the rigidity required for handling the cemented carbide tools and they had virtually double the power of those shown six years previously. Mechanical feeds were far more powerful. Electric controls contributed appreciably to cleaner appearing exteriors. Spindles were designed for and equipped with anti-friction bearings of the pre-loaded type. There was liberal use of advantages inherent in the new alloy steels in employing these steels for spindles, shafts and gears. Improved gears, being ground or lapped after heat treatment, added to smoother performance. Welding had been used successfully in the fabrication of components of a number of machines. Automatic lubricating systems were built into the equipment. Likewise, coolants were delivered from built-in low-pressure systems. Tolerances shrank to tenths of thousandths. On all types of machines the operations from roughing to finishing were substantially reduced. Direct reading dials displaced much manual handling of micrometers, gages and calipers. Hydraulically operated machine tools were commonplace. All of the machines were easier to operate.

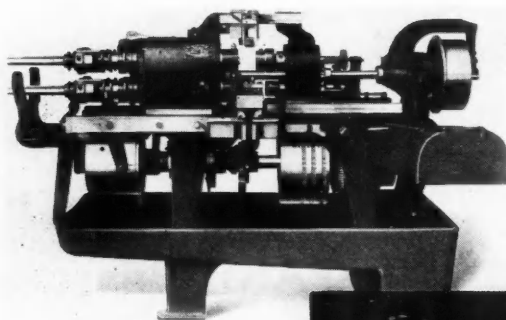
As the special section in this issue describing the 1940 models of the machine tool builders' will bear witness, the degree of accuracy and surface finish made possible by the latest equipment is of much higher order than that obtainable with the machines available four years ago. Speeds have soared, a development achieved by building greater rigidity into equipment, smoother operation and new methods of delivering coolant. Other benefits derived from building more weight into machines are the decrease of vibration and lengthening of tool life. "Streamlining" has been used widely to practical advantage in eliminating sharp corners, thereby removing one source of headaches for foundrymen, increasing the safety factor of the equipment and improving appearance. Electric drives are commonly built integral with the machines they power,

and electric controls provide automatic and "fool-proof" operation. Hydraulic operation of certain machine parts is being more generally adopted. Steady improvement of materials has, of course, played an important part in this saga of progress. Important, too, are efforts to standardize small tools and attachments, spindle noses, chucks and other parts. Unit type construction has come into wide favor. Now available are interchangeable unit mechanisms, such as headstocks, boring mill heads, drilling heads, drive units, spindle units, magazine-type work feeding units, and milling units. Many companies are, in fact, specializing in the manufacture of such units and supplying them to other machine tool builders.

A comprehensive survey of machine tool developments paralleling the 40-year commercial evolution of the motor vehicle would require at least several fat volumes and the combined efforts of many experienced persons. However, to supplement the generalizations already presented in this brief review, a number of machine tool builders courteously furnished the following information on improvements made in specific types of equipment over the period under consideration. While the details given in each case relate to the product of one manufacturer, they nonetheless will provide a reliable picture of the trend in design.

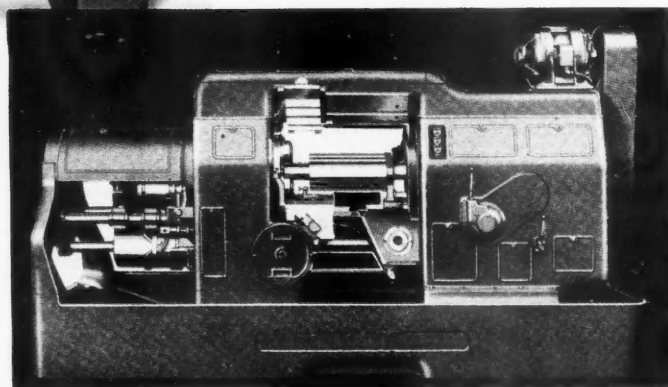
Milling

An engineer associated with a prominent producer of milling machines provides a broad account



(Above) An automatic screw machine built about 15 years ago.

(Right) Modern automatic screw machine built to sustain accuracy at the fastest feeds and highest spindle speeds that modern cutting tools can withstand.



of developments in this field. He refers specifically to the various methods employed for milling manifolds.

In the early stages the manifolds were held in a fixture which was set on the top of a milling machine table and one cutter was used to face the flanges in the same plane. The manifold was removed from this fixture, placed in a second fixture and the angle faces were milled. In finishing one of these manifolds it was not unusual to take a casting from one fixture to two, three, and sometimes four fixtures before all the faces had been milled. This necessitated first that several fixtures be made, second that four machines be used, third that four operators be used, fourth that four times the quantities of manifolds be in the factory

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The plants in which management is today laying the groundwork for the procedure and equipment necessary to provide for tomorrow's production requirements, are the plants that will meet this demand quickly and efficiently. Costly confusion and delay may be the penalty of procrastination; orderly production and sound profits the reward of preparedness.

For plants whose production involves machining operations, Carboloy cemented carbide is of exceptional importance in such a program. The ability of this material to increase production through higher cutting speeds (or feeds), and less downtime for tool changes, is an accepted fact established over a period of 10 years. As such, Carboloy tools are an invaluable factor not only in stepping up the productive capacity of existing equipment but also in obtaining maximum performance from new machine tools.

Past experience has shown that in each plant a period of adjustment is usually necessary in order to obtain the *full* benefits of Carboloy tool use. This is particularly true in cutting of steel with cemented carbides.

Our organization today has the man-power and time to assist you in establishing the best practice for cemented carbide use in your plant. Call upon us today to help your plant prepare to meet tomorrow's demand . . . with Carboloy tools.

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CARBOLOY CEMENTED CARBIDE TOOLS

40 Years MACHINE TOOL PROGRESS

at the same time, fifth that the chance for error was quadrupled, and sixth that the chance for error in machining these castings necessitated that an over percentage of the number required had to be run through these machines in order that the perfect finished pieces would conform to the manufacturing schedule.

The milling machine manufacturer, in order to correct this condition, devised ways of adding extra spindles, that is, an angular spindle or vertical spindle and possibly an inverted spindle, so that the manifolds could be milled on all the various faces at one pass. Fixtures for holding these manifolds were improved somewhat in that the nuts and bolts were replaced by levers which made it possible to load the fixture and clamp the pieces more quickly.

The design of milling machines was affected also by the introduction of new cutting materials such as Stellite and its various alloys. Plain bearings were replaced by anti-friction bearings and machines were speeded up so that actual cutting time was reduced approximately 50 per cent. Then Tungsten-Carbide was found to be very efficient material for cutting tools. Tungsten-Carbide tipped milling cutters required greater speeds and increased rigidity of equipment. Increases in spindle speeds and table feeds meant that ways and means for more rapid loading of the fixtures had to be devised. Compressed air displaced the conventional hand-clamping fixtures, then hydraulic means were used to hold the work-piece.

In general the trend has been from the use of the standard machine in the early days to the semi high-production equipment of around the 1920's, then extremely high-production machines in the late twenties, and finally the modern combination of standard machines with high production adaptations.

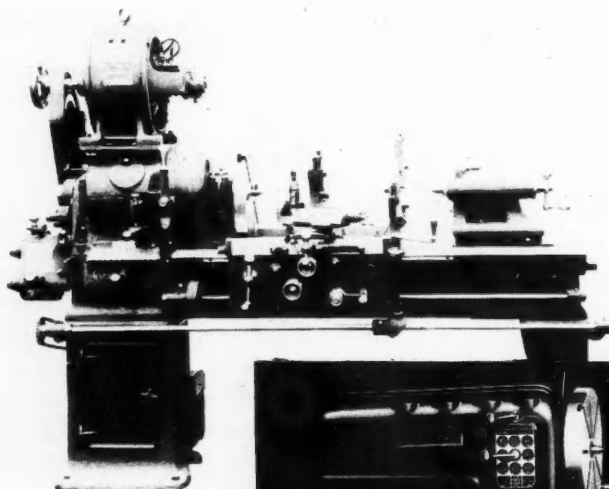
Photographs which illustrate the various developments are reproduced on page 346. One shows the method whereby a standard

machine, with a few simple clamping devices, milled usually a single surface. The other illustrates a special machine for extremely high production. The latter is a specially designed machine for milling an automobile engine block. On this machine the engine block is brought in on rollers to the cutting position. A large wheel at the top with a single turn clamps the block into position. The heads slide up the inclined plane, mill all the surfaces on the top of the block, slide back down. The engine block is rolled off on to a conveyor and the cycle is repeated.

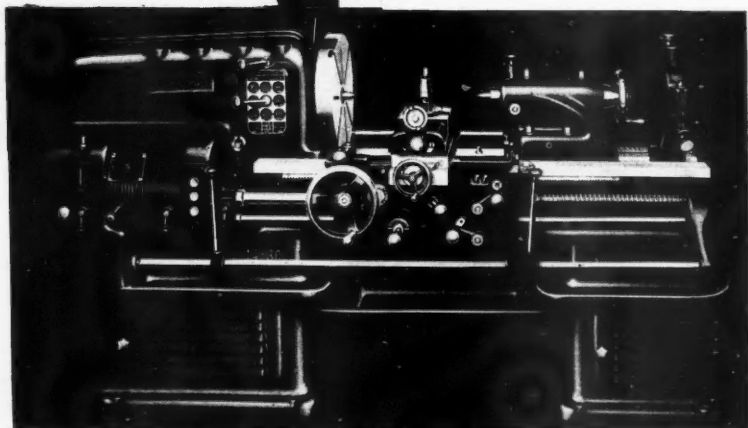
Automatic Screw Machines

Fifteen years ago a leading producer of this equipment was building four sizes of automatic screw machines, whereas today its line includes 25 sizes covering every production requirement for milled from the bar work. While the old type machines were available in four-spindle models only, this company today offers then in four-, six-, and eight-spindle models. There have been so many advances in design for accuracy, increased speeds and operating conveniences, that it is virtually impossible to enumerate them. However, one fact that is especially outstanding is the claim of this manufacturer that its newest machines will sustain accuracy at the fastest feeds and highest spindle speeds that modern cutting tools can withstand.

Among the refinements built into the new machines is an intermediate tool slide which makes possible not only the performance of more operations, but the additions of tools for the finer accuracies demanded by the heavy production schedules in the automotive plants. Anti-friction bearings and splash oil systems are now used, increasing both the accuracy and life of the machine with less power. The old machines used taper bronze bearings. The variety of standard and special attachments has been increased. These eliminate secondary operations, or those usually performed on equipment after the work leaves the automatic, saving the cost of extra machines. It is said that the current models of machines have in-



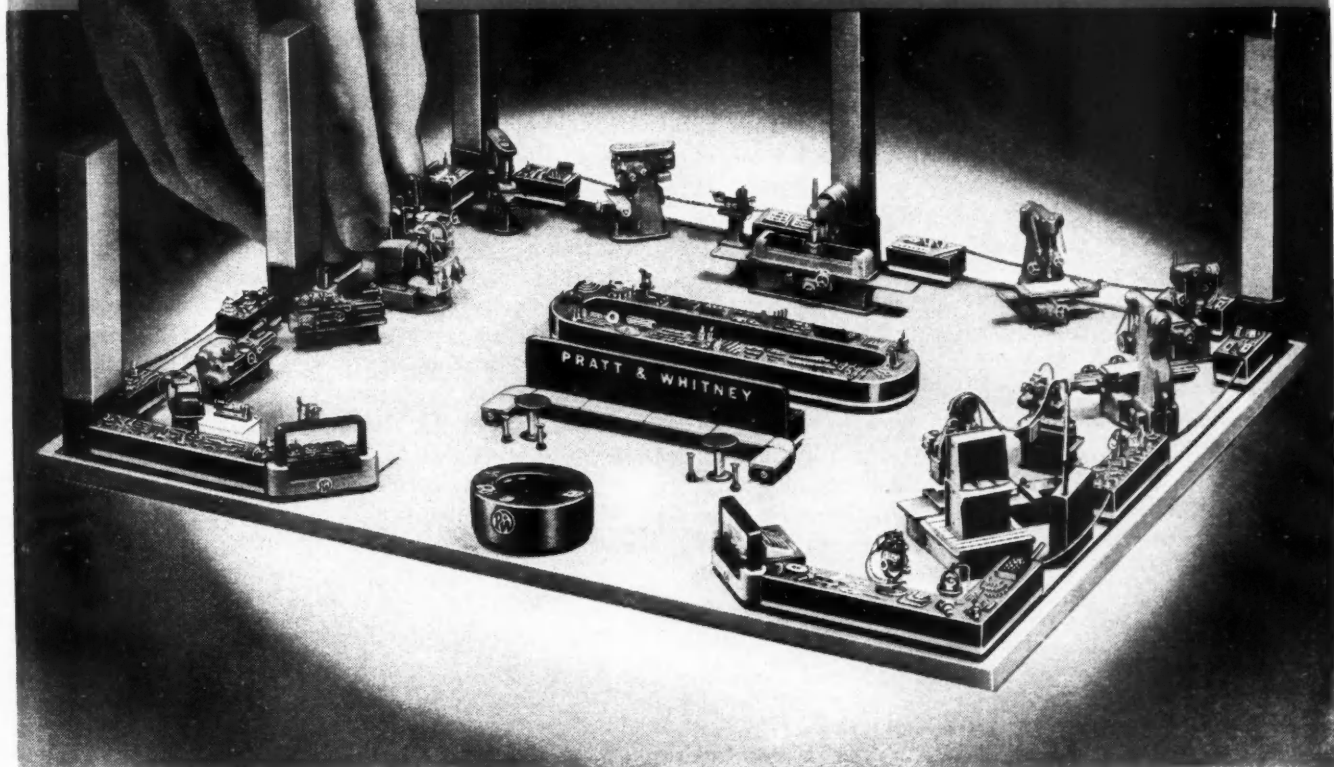
(Above) One of the first motor driven geared head lathes. It was built about 1905.



(Right) Modern streamlined lathe

(Turn to page 354, please)

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creased production from three to six times over the earlier models.

Lathes

The year 1905 brought forth a revolutionary step forward in lathe design in the introduction of the motor-driven geared head lathes. The design of one of the machines of that period embraced a four-speed geared head having a cast-iron gear transmission with the speed changes being secured through four straight jaw clutches. The driving motor on this particular machine was located on top of the headstock and connected to the initial drive shaft by spur gearing.

In 1910 this machine had been modernized in many respects, including a wider bed, external quick change gear mechanism, separate lead screw and feed rod, steel gearing and an eight-speed geared head, offering a combination of friction clutches and slip gears for its transmission.

While a number of minor changes and improvements were made in the succeeding 13 years it was not until 1923 that a major change appeared in the form of a 12-speed automatically oiled 100 per cent anti-friction geared head with the motor mounted in a large cabinet leg under the headstock.

From that point on refinements have been incorporated into the design of this machine, so that today its exterior appearance is streamlined in keeping with the modern trend, it has inherent characteristics that add materially to the efficiency of the engine lathe, and greater convenience of handling and ease of operation.

Radial Drills

The files of an old established builder of radial drills reveal that the company was building a gear box driven and geared head radial drill in 1900. Following this, a round column type with gear box drive and guarded geared head was offered in 1912. Six years later another

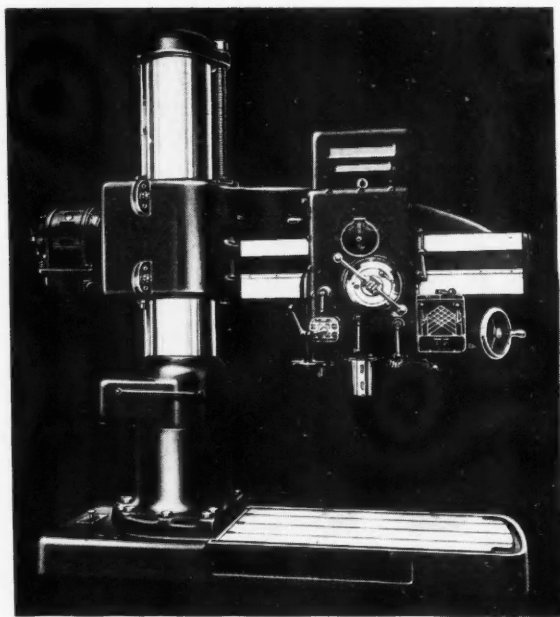
radical development was announced. This was a machine with completely enclosed head and numerous other improvements that greatly increased both the production capacity and the factor of safety that had been sadly lacking in former designs.

Only a few years later, about 1920, another change was inaugurated which consisted of locating the driving motor on the radial drill arm. From 1920 to the present, improvements have moved toward modernization with respect to power, stamina, convenience of operation and ease of handling.

Threading Machines

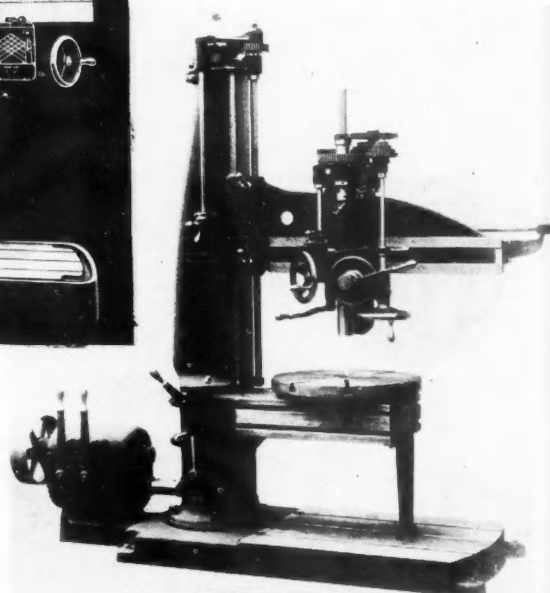
One of the newest machines of this type is equipped with an eight-speed selective gear box. All gears are cut from chrome nickel steel and are heat treated and burnished. Anti-friction bearings are employed throughout and the die head spindle is mounted on pre-loaded anti-friction bearings. Hardened and ground carriage guides are protected by steel telescoping guards and by wipers at the front end of the carriage. The bed, cast in one piece, is of double wall construction with transverse bracing members. High-carbon steel has been used for the die head or turning head, and all parts are heat treated. Rigidity of the head on this machine assures that work will be held within close tolerances diametrically, and the fine adjustments of the hydraulically controlled cycle make it possible to hold within extremely close limits for length where a shoulder must be faced.

Compared with this modern hydraulically controlled machine, the earlier machines made by the same manufacturer, are much out-dated, not only in appearance, but also in mechanical refinement. On the earlier machines five speeds were available through a five-speed cone pulley mounted over the headstock. Plain bearings were employed throughout, being bored directly through the



(Right) Said to be the first gear box driven and geared head radial drill. This machine made its appearance about 1900.

(Above) Modern conception of the radial drill

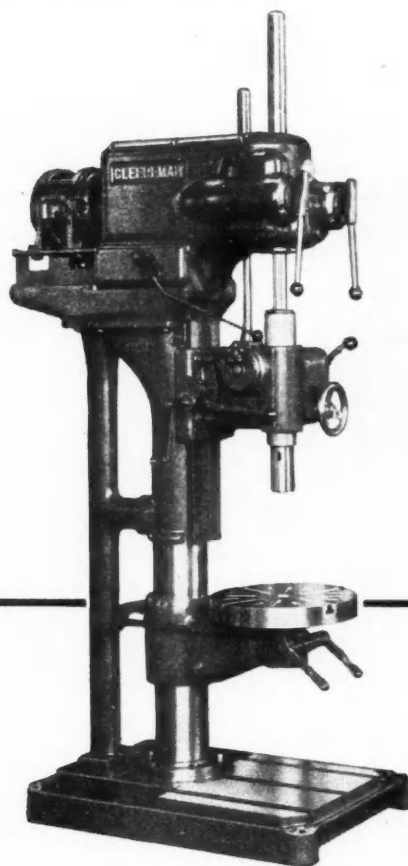


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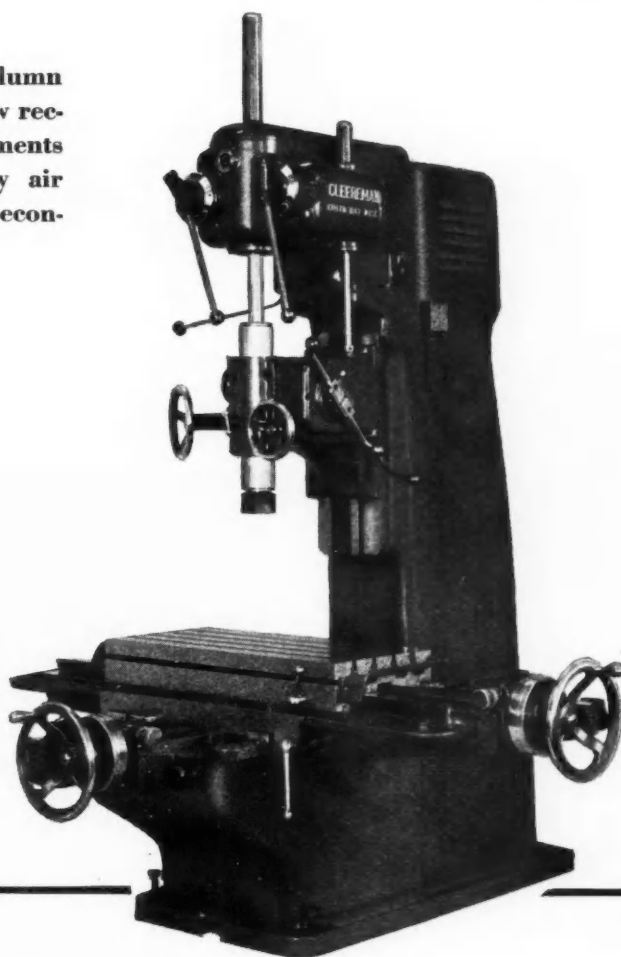
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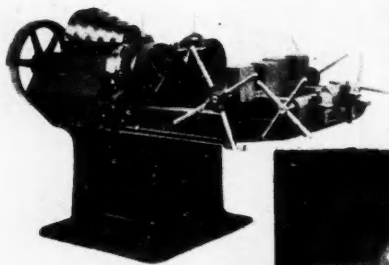
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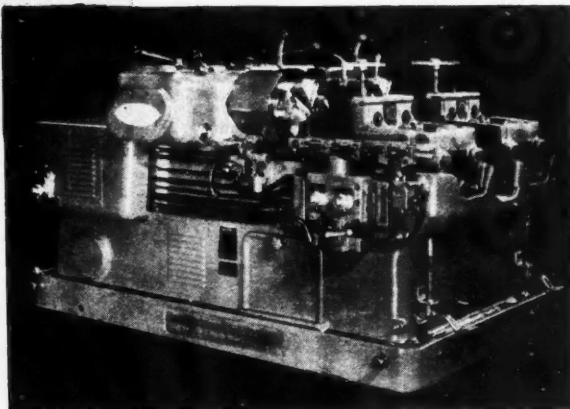
40 Years of MACHINE TOOL PROGRESS

casting. This was true also of the die head spindle. Gears, die heads, chaser holders and carriage guides were made of cast-iron, the guides being formed by merely planing the top surfaces of the machine bed. The carriage was not gibbed to the guides and no provision was made to take up wear. In general it may be said that the threading machines which were built in the embryo days of the automotive industry were capable of producing commercial threads required at that time, but these machines had neither the rigidity nor the accuracy which is necessary to produce the threads within the close tolerances now required.



(Right) Late model of hydraulically controlled threading machine. Such equipment also employed for turning operations.

(Above) An earlier model of the same type of machine.



Shears

The steel shears made years ago could not meet the demands of mass production. Frames and rams of the early-type machines were made of cast-iron and breakdowns were common. Another problem was deflection, which resulted in inaccuracies. As steels were improved, however, all-steel plate construction was used to advantage in the construction of more accurate and faster shears.

A modern make of shear, in addition to all-steel plate construction which adds to strength and minimizes deflection, incorporates the following improvements: Hydraulic holddowns that deliver a gripping, uniform pressure along the full length of the work, preventing slippage regardless of variation in thickness; large throat to accommodate slitting and notching operations; electrically controlled gaging equip-

ment; automatic lubrication; and, complete safety guarding for the operator.

Press Brakes

One manufacturer of these machines states that the greatest advance in the construction of press brakes is the use of steel plate for housings, beds and rams, replacing the old cast-iron types. Users of these machines in the early days were confronted with a tremendous problem of housing, ram and bed breakage. In the words of one manufacturer, "The old-timers relate that one could tell how much a brake had been used by the number of welds that scarred the machine—the repairs after breakdowns." Today the press brake is used for forming, bending, corrugating and punching a wide variety of metals. It is claimed that all-steel plate construction, when properly executed, is a guarantee against breakage in the frame and against deflection of consequence in the bed and ram.

One of the newest types of press brake is automatically lubricated, has motorized ram adjustment, ram tilting for cone work, open frame throat construction to remove limitations on width of material handled, disk clutch, and micrometer indicators. The pitmans on the machines in this line are concentric to the housings, evenly distributing the load.

Shapers

The shaper was just as important a machine tool in the early days of the automotive industry as it is today. The 1904 catalog of a manufacturer of these machines shows that back gearing was an important feature of the then current models. It had been developed to supersede the former single-gear type. This same manufacturer names the improvements in machines of this type between 1904 and 1939 as follows: power rapid traverse; eight-speed internal transmission; automatic lubrication; graduated dial indicators to all movements; complete gibbing on all sliding surfaces; self-contained motor drive; anti-friction bearings; increased capacity; greater accuracy; the universal table; and, complete safety guarding of the machine.

On one of the newest designs of shaper, rapid power traverse is provided for moving the table rapidly in either direction. Automatic crossfeed to table is operated by a single cam synchronized with the return stroke of the ram. Sixteen changes of feed from 0.006-in. to 0.100-in. are available. A direct reading feed dial indicates the feed changes, and direction of feed is controlled at the rail. The tool head is arranged with a single control head lock which locks the tool head in any adjusted position. A circulatory pressure system of lubrication provides oil by pressure directly from the pump to the ram guide ways and the entire linkage system, including the main crank block and linkage pins. The universal table can be swiveled 180 deg. and the tilting work surface adjusted 15 deg. in either

(Turn to page 358, please)

TOUGH STOCK MACHINED ACCURATELY AT HIGH SPEEDS...

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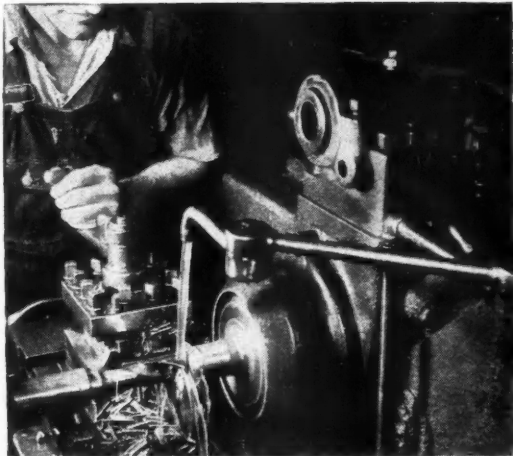
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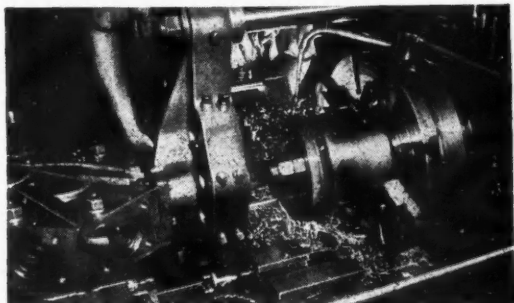
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DRILLING DROP FORGINGS in the plant of The Oil Well Improvements Company, Tulsa, Okla. They use Texaco Transultex Cutting Oil.

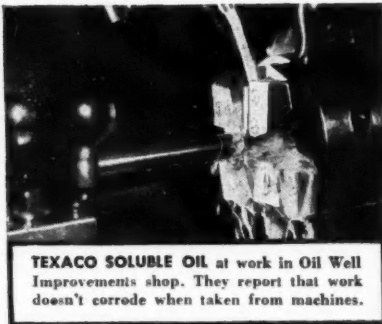
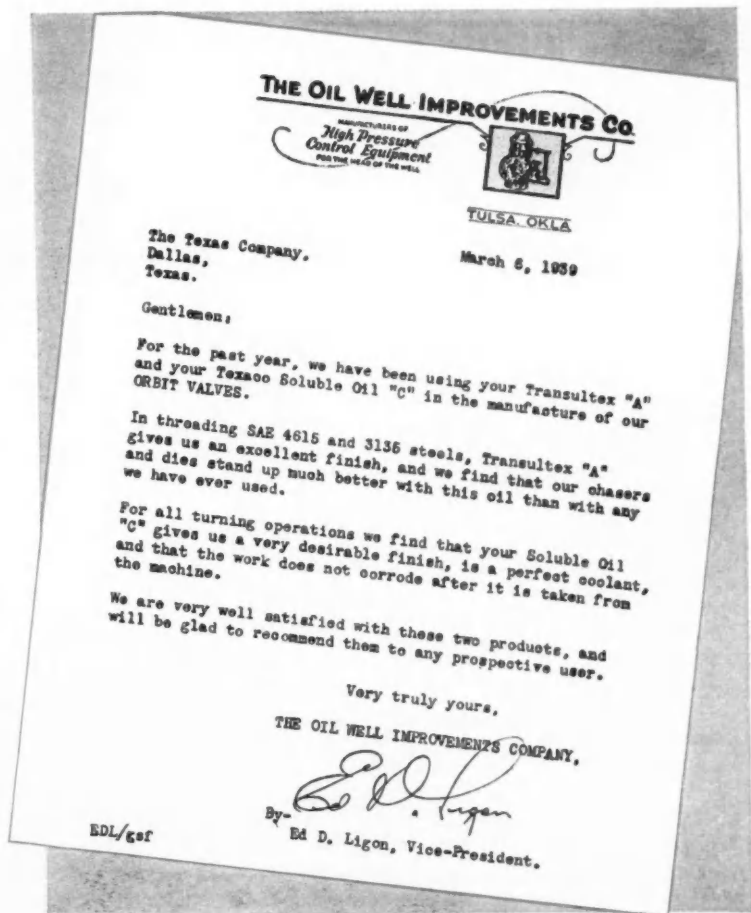
OIL WELL IMPROVEMENTS COMPANY reports that Texaco Transultex Cutting Oil adds to tool life.



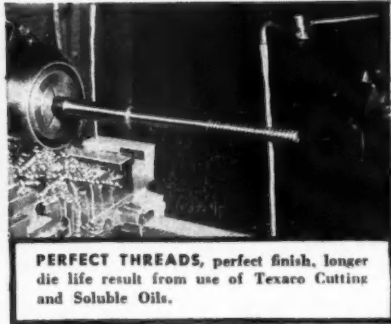
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October 1, 1939



TEXACO SOLUBLE OIL at work in Oil Well Improvements shop. They report that work doesn't corrode when taken from machines.



PERFECT THREADS, perfect finish, longer die life result from use of Texaco Cutting and Soluble Oils.



TEXACO

CUTTING AND SOLUBLE OILS

40 Years of MACHINE TOOL PROGRESS



1. A loose cam grinding operation dating from the early 1900's when the automobile camshaft was made up from a series of sleeves, each having an inlet and an exhaust cam.

2. An integral camshaft and a rocking bar type of cam grinding attachment which was driven from a standard belt drive headstock. Note the table type truing device which had to be placed and removed for each truing.

3. A step forward. Here the headstock was motor driven and the cam attachment had an automatic indexing arrangement whereby the rocking bar was lifted pneumatically so that the master cam roller could be moved from one master cam to another. Note the method of drive for the grinding wheel—belting from a motor on the floor through idlers to a binder frame arrangement and thence to the center of the wheel spindle.

4. The cam attachment on this machine was driven by a large pulley arrangement and did not require the use of a headstock. Note the pedestal and the long countershafting to permit table traverse.

5. An early development of an automatic cam grinding machine. Such features as automatic feed of the grinding wheel, automatic hydraulic indexing of the table as well as the master cam roller, automatic reciprocation of the grinding wheel while grinding, and automatic truing of the wheel after each camshaft was ground were inaugurated with this machine.

6. One of the first machines to be individually motor driven, marking a departure from long leather belting and idlers.

7. Further refinements were incorporated into this machine with the wheel spindle being driven by vee-belts, not in the center, but at the right end, on which a sheave was mounted. Reciprocating motion now imparted

The Development of Cam Grinding shown with pictures

to the spindle from a mechanism within the housing between the spindle bearings. Wheel spindle bearings automatically flood lubricated and base ways, wheel slide ways, and feedscrew force feed lubricated. A cycle timing unit gave each cam the same number of revolutions in contact with grinding wheel.

8. A change in the style of drive to the master cam spindle and the work. Note that the motor is positioned differently. Adjustment for the rate of grinding feed of the wheel greatly simplified and improved.

9. One of the latest types of automatic cam grinder. Some similarity to earlier types will be observed. With this machine, however, a marked step forward is in the manner of feeding. All earlier models fed the complete wheel unit forward, first rapidly, then slowly at a grinding feed. Consequently it was necessary to provide means for operating a unit weighing nearly a ton back and forth about 300 times an hour.

With the new model the wheel unit remains stationary except for the small amount of feed required when the wheel is trued automatically after each shaft. The feed is accomplished by moving the rocking bar, which supports the shaft during grinding, inward toward the wheel. This action is produced by a very slight eccentric rotation of the cam roll shaft and the design of the mechanism is such that a feed as minute as a few thousandths per minute can be obtained. A positive stop limits the final position of the roll shaft and consequently the size of the product ground.

(Turn to page 360, please)

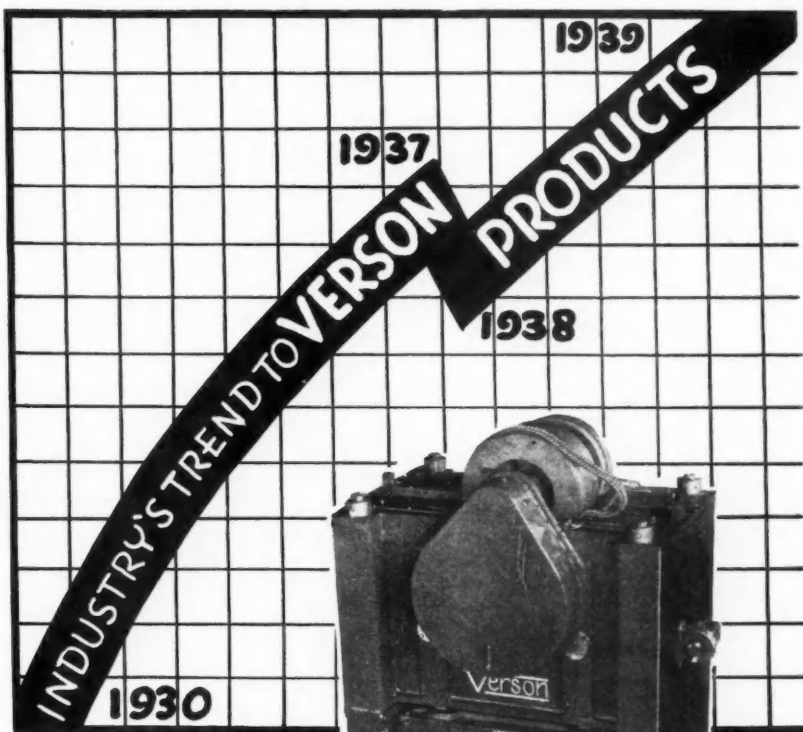
TRADE **Verson** MARK **PRESSES**

*used more and more by industry
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production—
improve
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FIRST IN THE FIELD.

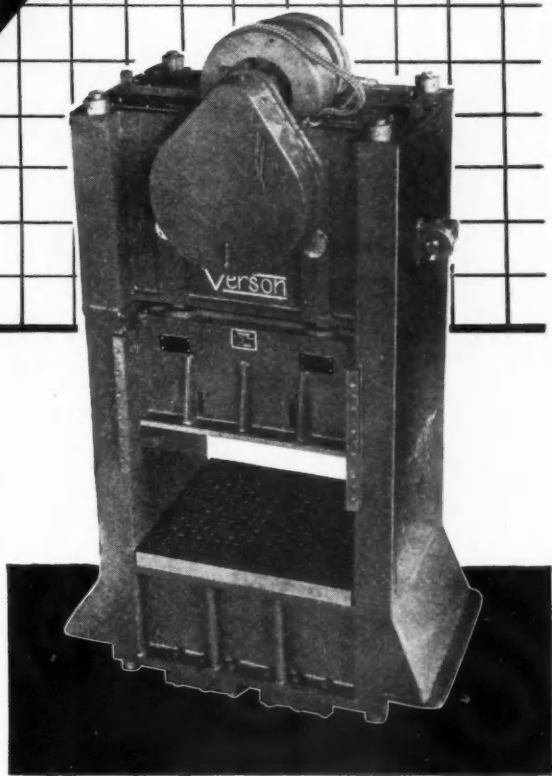
- with Unbreakable Fabricated Steel Frames
- with Streamlined Design and Construction
- with Many Outstanding Engineering Features



INDUSTRY is always seeking ways to cut costs . . . speed production . . . make better products . . . and the ways are always found. Verson Allsteel Presses offer those advantages to the metal working field—the result has been an ever increasing demand for Verson Products.

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*This is a 400 ton Verson 4-point
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*Sold by Leading
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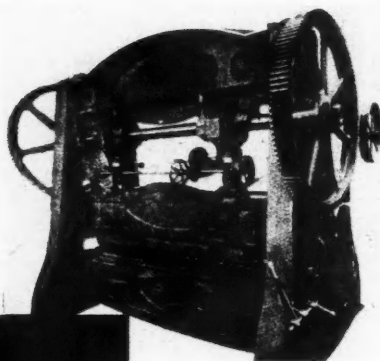
direction. The foregoing are just a few of the many features on one modern make of shaper.

Gear Cutting Machines

The gear hobbing machine has followed closely the demands of the automotive industry for greater accuracy and increased production at lower cost. The manufacturer which supplied the information on these machines states that it brought out in 1905 the first

(Right) An old cast-iron press brake.

(Below) Modern all-steel press brake.



automatic spur and helical gear hobbing machine developed in the United States. In 1922 when the trend was in the direction of single purpose machines, this company developed an entirely new type of high production gear hobbing machine. This machine had the work table fixedly located in the base and the stanchion, which carried the hob slide, was the movable member. These machines were developed for the extensive production of spur type gears, particularly automobile transmission gears, on which type of work new records of production and accuracy were established.

When the first automobile synchromesh transmission with helical gears was announced in 1929, this company augmented its line with a machine of the universal type suitable for both spur and helical gears.

The latest product of the same concern is of compact design and heavy construction. Naturally it is capable of much greater production than the first universal manufacturing gear hobbing machine. In addition to increased production resulting from faster hob speeds and greater feeds, it is claimed that substantial savings in hob cost have been made possible by the unusual rigidity and principle of construction. Rapid power traverse to the hob slide on the new machines also facilitates faster and greater ease of reloading the work. The hob spindle, likewise the work spindle are arranged with independent adjustments for maintaining the diameter and end fits of these members. Adjustments can be made without disturbing the set-

ting of the other or removing the spindles from the machines. Circulatory pressure lubrication, heat-treated gears, multiple spline shafts, together with the extensive use of anti-friction bearings, have contributed materially to the advance of greater accuracy and increased production.

Grinding Machines

In this field the advances made in cam grinding serve as an excellent example. The evolution of cam grinding equipment might be divided into three stages, as follows:

1. the loose cam attachment, 2. the integral cam grinding attachment, and 3. the automatic cam grinding machine. The loose cam attachment was used in the early 1900's when the automotive camshaft consisted of a series of sleeves, each having an inlet and an exhaust cam. After the grinding operation, these sleeves—one for each cylinder—were mounted on a shaft and finally pinned to position.

The advent of the integral type camshaft ushered in the next stage. The entire shaft now had to be handled, and to meet this problem a "rocking bar" type of attachment which could be used with a standard cylindrical grinder was developed. The master cam spindle, camshaft and foot stock were mounted on the rocking bar and were free to "rock" against spring pressure as the master cam revolved against a master cam roller having a fixed axis. After each cam was ground both the table and the master cam roller had to be moved by hand. Automatic mechanical indexing of the master cam roller soon evolved which relieved the operator from shifting by hand. In addition, the standard machines on which these attachments were placed were changing greatly. Heavier bases, sturdier, self-contained wheel units, larger grinding wheels, force feed lubrication and individual electric drive in place of overhead countershafting and belting were but a few of the many improvements. This integral cam grinding attachment is still used today where the production does not warrant the use of the automatic cam grinder.

(Turn to page 362, please)

RotoMill REPLACES TURNING-

**OFFERS
REMARKABLE
ECONOMY
AND SPEED**

TRADE MARK

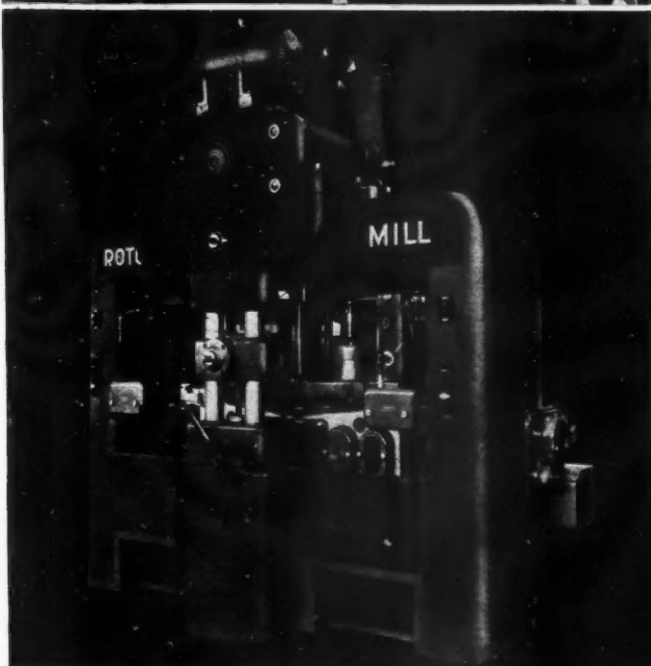
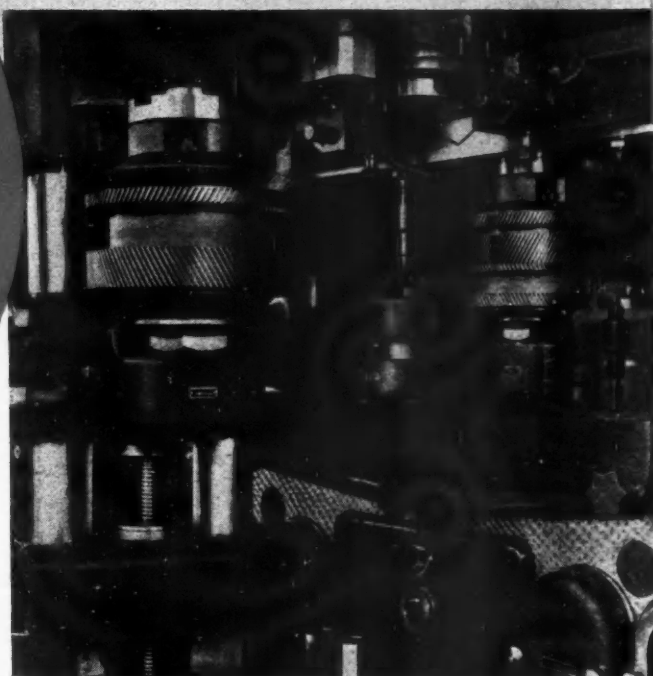
In the RotoMill, the work piece is revolved slowly between milling cutters which replace the standard single end lathe tools. The cutters are placed on opposite sides of the work piece to balance the cut. The work piece moves from the loading position in between the cutters and is then revolved through 370 degrees, the extra assuring completion of cut.

Any type of cylindrical, conical or flanged work may be machined, at a speed vastly greater than for lathe work. Set-up is speedy—two operators can set up an entirely new job in about 80 minutes. This ease of change provides remarkable economy on both short and long runs.

Accuracy of .005" indicator reading is readily attained in a single cut from rough.

Two sizes of RotoMill are available. RM-6/10 takes work 1" to 6" in diameter—10" maximum length. RM-10/24 takes work 2" to 10" diameter—24" maximum length.

• Write for RotoMill Bulletin •

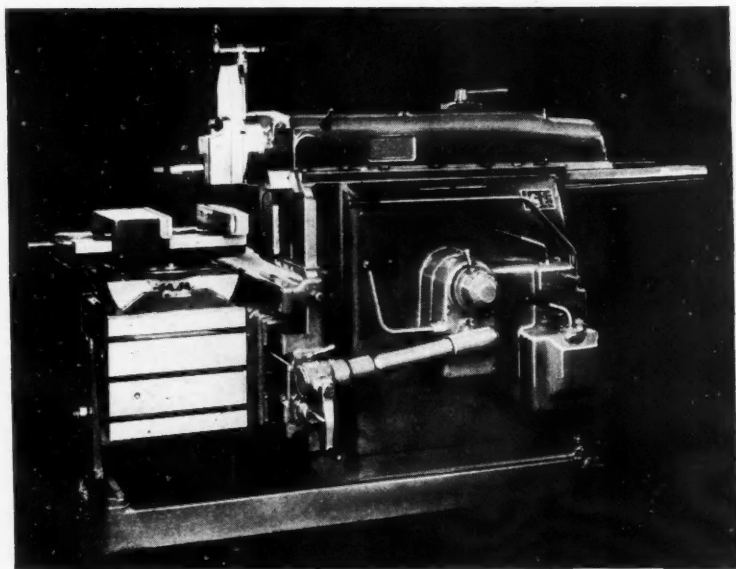


NATIONAL BROACH AND MACHINE CO.

SHOEMAKER AND ST. JEAN • DETROIT, MICH., U. S. A.

40 Years MACHINE TOOL PROGRESS

As their contribution to the mass production era of the automotive industry, the grinding machine manufacturers developed automatic machines for grinding certain parts. One of these was the automatic cam grinding machine which was for one purpose only—to grind cam contours rapidly and accurately. Such features as automatic feed of the grinding wheel, automatic indexing of the table as well as the master cam roller, automatic reciprocation of the grinding wheel while grinding and automatic truing of the wheel after each camshaft was ground, were inaugurated with this machine. The operator



(Right) In the 1890's this shaper with an extension base having a front support and guide for the work table was introduced.

(Above) One of the latest types of shaper with swivel table and tilting top.

merely had to place and remove the camshaft and the machine did the rest.

These machines have been greatly refined and improved so that today the production of camshafts has increased from 50 to 100 per cent per machine, as compared with the integral cam attachment type. This, plus the fact that an operator can attend two, three, and in some cases four machines, has stepped up production considerably and at the same time the finish has been improved.

Before we close this sketchy account of "40 years

of progress" in the machine tool field we wish to briefly discuss two developments that are currently having much influence on equipment design. One of these is styling, and the other, quite closely related, is the increasing use of welding in fabrication of machine tools.

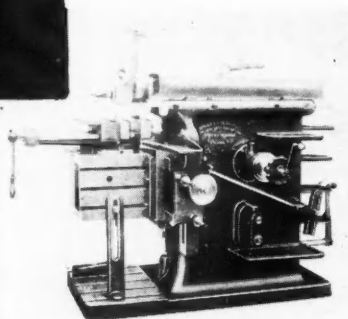
Efforts to improve the appearance of machine tools with very practical ends in view have increased considerably in the past few years, a trend aided by industrial designers whose activities heretofore have been leagues away from the machine tool industry. The first serious attention in this direction was given to locating controls to facilitate ease of operation. Elimination of sharp corners and the introduction of smooth-flowing curves not only resulted in a machine easier to keep clean, but actually reduced costs of production. Further, the cause of safety was advanced, in that the chances for an operator injuring himself on projections and sharp corners were considerably reduced.

The use of welding in the fabrication of machine tools is one of the newest developments, and several

of the more progressive machine tool builders have conducted numerous experiments in this field. In fact, some manufacturers have adopted this method of construction to several of the machines in their lines. One manufacturer who has done considerable work of this sort emphasizes the importance of considering the matter of appearance, stating that a certain styling which was sound for cast-iron is not necessarily going to work out satisfactorily when steel is used. In other words, certain styling must be established that will fit into the use of fabricated structures.

It appears that cast-iron will be found more desirable as the material for those machines which are built in quantities and would require

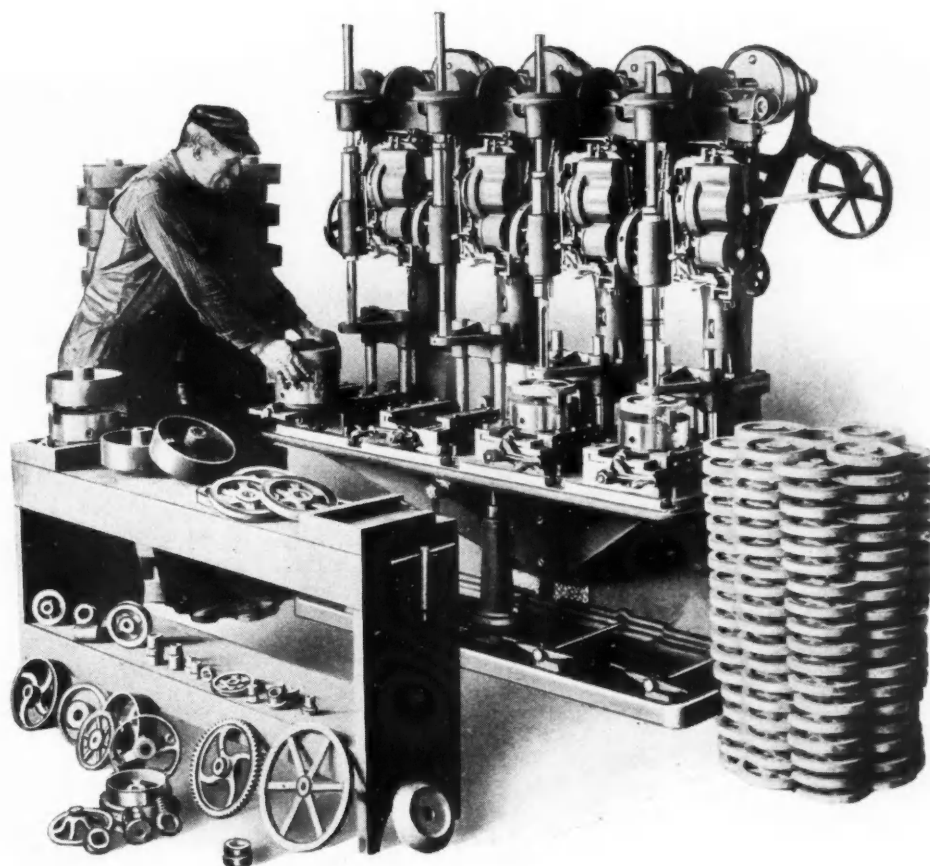
castings of rather complex shape. On the other hand there are certain special structures which are not practicable to cast. Economics of construction favoring one or the other plays its greatest part in the border line cases. Many advantages in addition to those mentioned are advanced by the proponents of welding. Among these



are that on the whole the cost of the welded structures has been decreasing, properly designed welded structures average about 20 to 40 per cent lighter in weight than castings for the same job, builders are able to make quicker delivery on a steel bed machine as compared with a cast-iron machine, percentage of scrap is high with castings that are complex, and greater freedom of construction in the sense that with the welded structure it is possible to make preliminary tests and minor changes if desirable.

This concludes our picture of some of the outstand-

(Turn to page 364, please)



With Potential Power of Eight

This man really worked. He practically ran from station to station of the four-spindle gang drill—ran for eight, ten, and sometimes twelve hours each day. If he was equally as fast, as he was strong, he could drill and ream 100 pulleys—of the type shown—in an hour.

Today he could produce these pulleys with an entirely different machine—yet, in principle, a very similar machine. The stations are mounted around a center column. Each station maintains an individual operating cycle, feed rate, and length of stroke. The work is clamped and indexed to the operator automatically. Therefore, without spending

the greater share of his time chucking and chasing the work from station to station, our operator could produce 800 pulleys an hour without moving a step, and, if wanted, add several additional operations.

The foregoing is a hypothetical case based upon our knowledge of gang drill work and the performance capabilities of our new center column machine. It's doing equally good work in several automotive plants today; for other industries it's a machine of tomorrow.

But, if you have parts in your plant that can be machined on gang drills, need high production, yet treat your operator with consideration, don't

overlook our new center column machine. It doesn't matter if your parts are all identical or an assortment. They may be an accumulation of dissimilar parts which will equal, in number, a mass production job. The machine is capable of handling almost any combination of drilling—boring—milling and tapping operations. One has been supplied to perform 14 operations on a front cover for an automobile cylinder block.

You are invited to write for our latest booklet "Since 1872" wherein this, and one outstanding machine for each of several progressive industries, is illustrated.

W. F. AND JOHN BARNES COMPANY • ROCKFORD, ILLINOIS

Automotive Industries

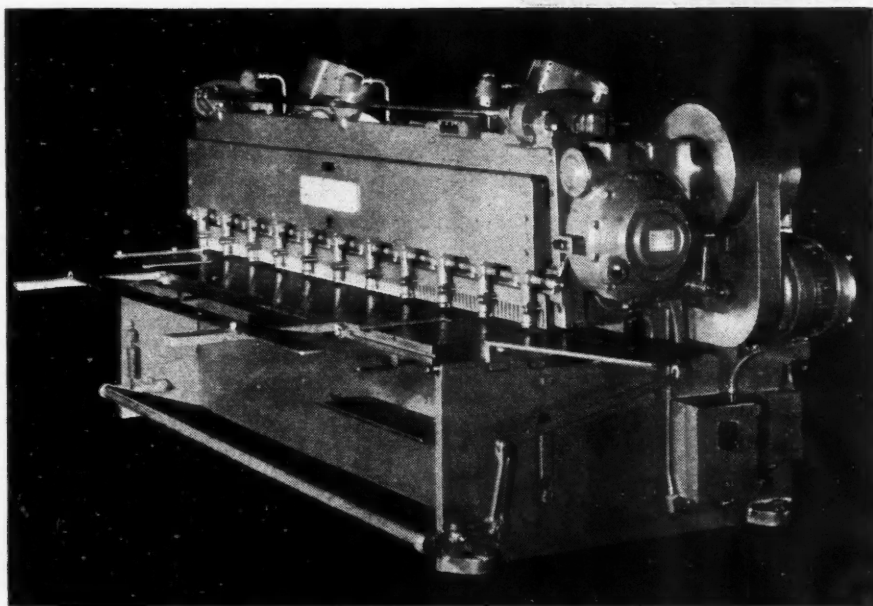
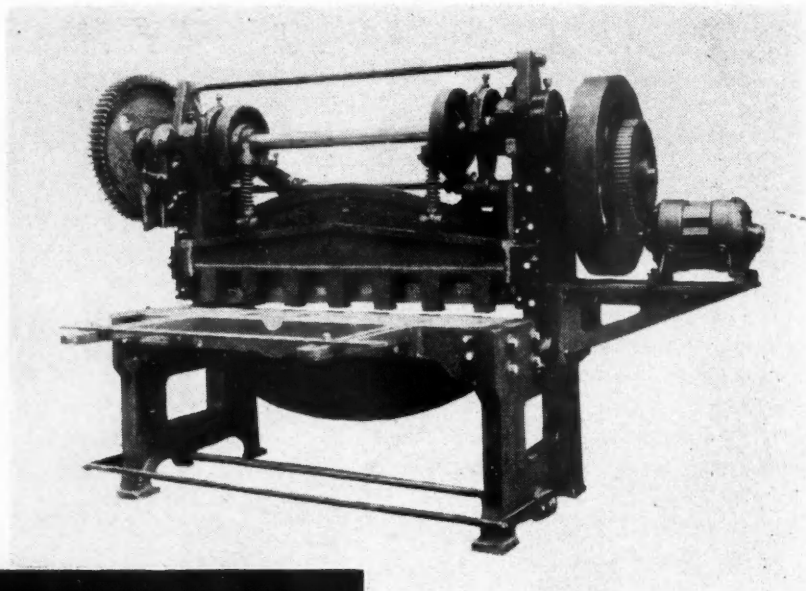
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40 Years
MACHINE TOOL PROGRESS

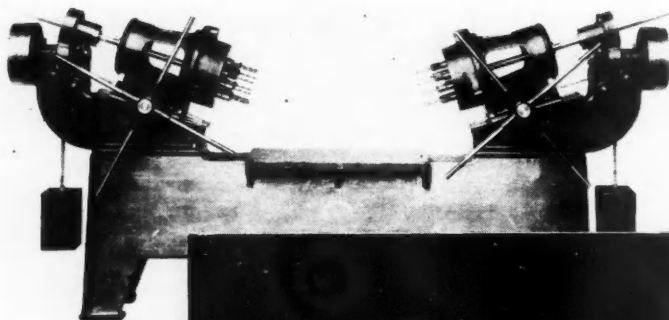
(Right) An old cast-iron shear.

(Below) Modern all-steel shear.

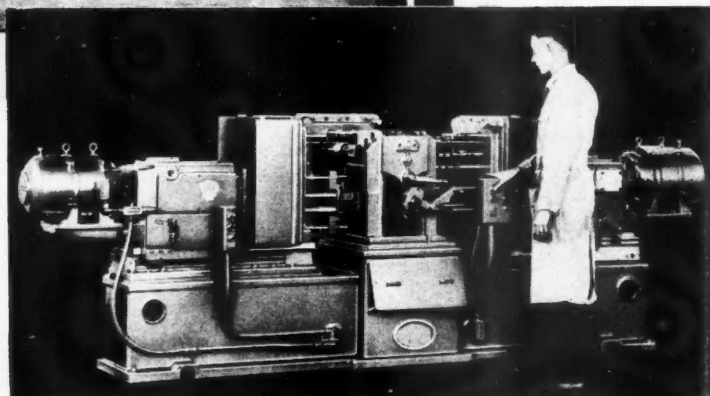


Eberhardt; Norton Co.; The Cincinnati Shaper Co.; Landis Machine Co., Inc.; and the National Machine Tool Builders' Association. A number of manufacturers were unable to comply with our request for information for this review due to the stress of unusual circumstances. These and any other producers of machine tools who believe they have something to add are cordially invited to submit material at any time in the future. Such material will be reported in our regular machine tool feature, *Men and Machines*.

ing developments in machine tools which have accompanied the automotive industry's 40-year march forward to greater technical achievement. We extend special thanks for assistance to the following: The National Acme Co.; The American Tool Works Co.; Kearney & Trecker Corp.; The National Automatic Tool Co.; Gould &



Multi-driller used in the automotive industry about 1914. This machine has a double hand feed, exposed chain counterweighted heads which were belt driven. Lower view shows the new-type multi-driller.



These are the Tools of Tomorrow

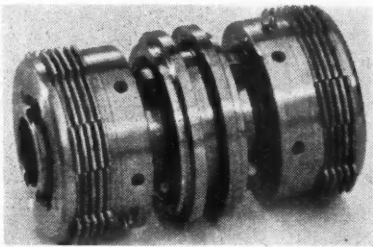
(Continued from page 334)

tables are mechanically interlocked so that only one can be in the broaching position at any one time.

Clutch for Machine Tool Applications

The Twin Disc Clutch Co.'s latest development in clutches especially designed for machine tools is the model MT which is compact, has relatively high torque capacity and requires comparatively low operating pressure.

This clutch is available in both single and duplex models, and each model is made in two types, one for "dry operations" and another for "in oil" enclosed operation. The duplex model consists of two single



Twin Disc Clutch Co.'s model MT (duplex) clutch for machine tool applications.

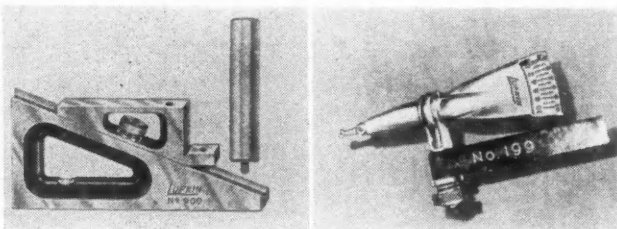
clutches combined in a single unit and having a common engaging cone and operating lever. This model may be used as a two-speed drive or one of its clutches may be used as a brake or as a power reverse drive.

Lufkin Develops New Indicator and Gage

To its line of precision tools the Lufkin Rule Co., Saginaw, Mich., has added a universal indicator (No. 199) and a master planer and shaper gage (No. 900).

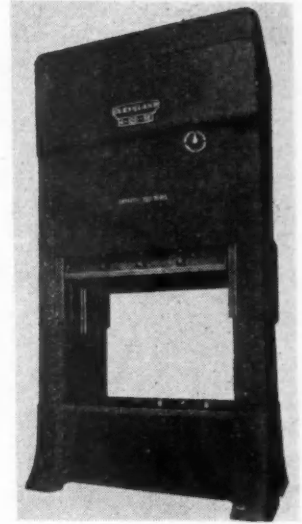
Location of the reading faces on the indicator is mentioned as a particularly valuable feature. One of the reading faces is on the front or flat side, the other on the end or top, making the indicator especially suitable for jig boring, milling machine and drill press work.

The indicator is built in one unit, makes a complete revolution on its own center and also on the clamping bolt. Contact point and all working parts are hardened.



(A) Master planer and shaper gage and (B) universal indicator which have been added to the line of precision tools made by the Lufkin Rule Co.

Four point suspension press of 750 tons capacity and measuring 120 in. between the uprights which was furnished recently to a leading automobile manufacturer by the Cleveland Punch & Shear Works Co., Cleveland. The press has a 60-in. shut height and 30-in. stroke. It is symmetrical front and back, except for the indicator located on the front to show the position of the stroke. Drive unit and gearing, which are in the box-type crown, are easily removable



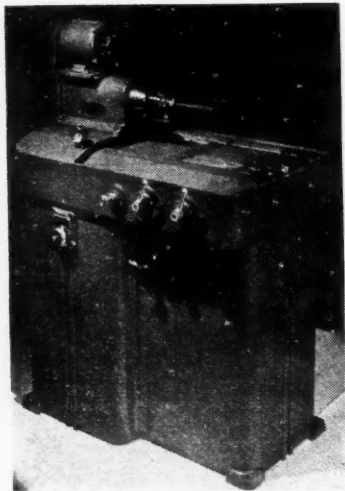
Surfaces on all sides of the master planer and shaper gage are precisely ground. The slide travels in a ground and beveled slot, eliminating side play and assuring accuracy. The gage can be used on its base, on end, also flat on either side, inasmuch as both slide and nut are within the outside width of the base and both sides are ground square with the working edges. A three-inch extension, regularly supplied with each gage, makes possible settings from 1/4 in. to nine in.

The model V-36 Doall contour sawing machine built by Continental Machines Inc., Minneapolis, Minn. While this machine is basically a shape cutting machine, it also operates file bands and polishing bands for jobs that require high finish after the sawing operation



Honing Machine for Work of Small Diameter

The Micromatic Hydrohoner, produced by the Micromatic Hone Corp., Detroit, is a honing machine for work of small diameter. It is designed to permit of substantial stock removal, uniformity of diameter, and a smooth surface finish. The machine provides a selective, wide range of speed combinations of rotating and reciprocating spindle travel. The relatively high speed abrasive motion thus produced is combined with a low-speed reciprocating movement of the work, which is chucked or loaded in a fixture and mounted on the hydraulically-actuated work table. In the oper-



*Micromatic
Hydrohoner*

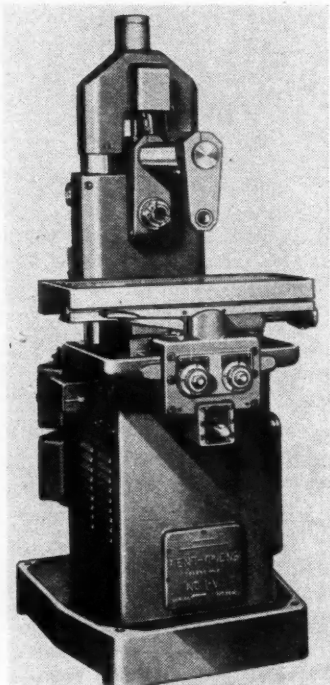
Automatic Vertical Head Feed on New Hydraulic Milling Machine

Combination of a horizontal spindle with an automatic hydraulic vertical head feed is the outstanding feature of the new No. 1-V milling machine made by Kent-Owens Machine Co., Toledo, Ohio.

The head movement is actuated hydraulically by a separate motor driven pump which is mounted as a unit assembly in the base. The head has vertical feed in the down direction only and rapid travel in both the up and down direction. Any feed from 1 in. to 80 in. per min. can be obtained by operating the control dials on the front of the machine. On the rear of the machine are adjustable dogs which can be set to obtain the desired cycle of head movement.

The head is mounted on two ground cylindrical steel posts with the head actuating cylinder and piston assembly above them. The head is counterbalanced so that it will not settle to the lower position when the machine is idle.

The spindle is driven by a standard foot mounted ball bearing motor at the rear of the machine. There are only two gear contacts between the motor and the cutter. One of these is a pair of pick-off gears by means of which any speed desired from 100 to 2000 r.p.m. can be obtained.



*No. 1-V milling machine made
by the Kent-Owens Co.*

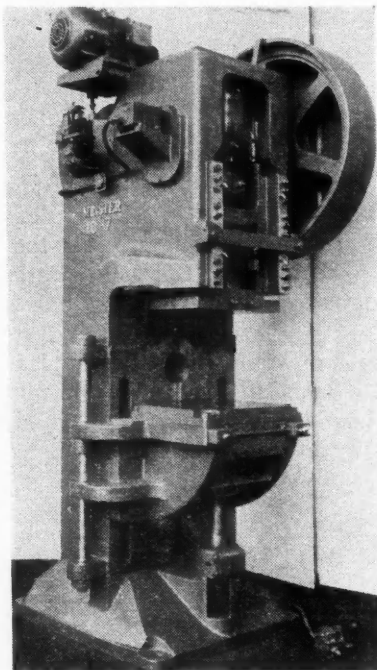
ating cycle, the work is moved up automatically to the working position, and the table is slowly reciprocated through its predetermined working stroke.

Minster Machine Co.'s New Honing and Wiring Press

One of a number of newly designed honing and wiring presses, built by the Minster Machine Co.,

Minster, Ohio, has a 71-ton capacity and is equipped with an electrically controlled air operated friction clutch and brake.

The frame is of heavy cast semi-steel construction, so designed that with the use of an adjustable swinging table, the capacity and most of the advantages of a gap press, in addition to honing and wiring, are obtained. The opening in the frame will accommodate a horn shank 7 in. in diameter.

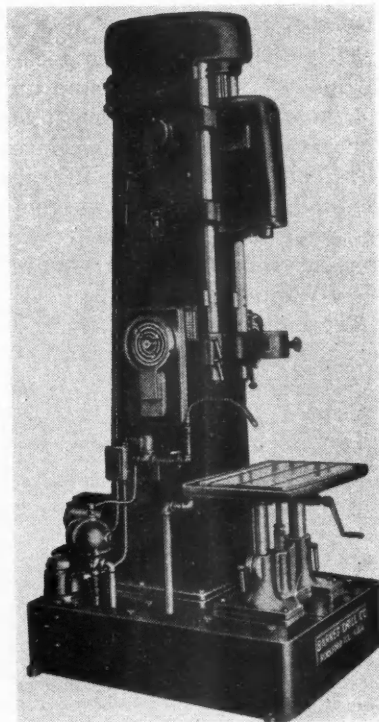


*Minster 71-ton honing and wiring
press.*

Barnes Drill Co. Honing Machine

Barnes Drill Co., Rockford, Ill., has developed a new honing machine which it designates as the model No. 224. Spindle travel of the machine illustrated is 22 in. Normal travel, however, is 16 in., but in this particular style up to 40 in. travel is available.

The manufacturer calls attention to the circular mounted stops on the side of the column which, through chain drive on the inside, eliminate entirely the vertical stop rod used on most of the Barnes vertical machines.

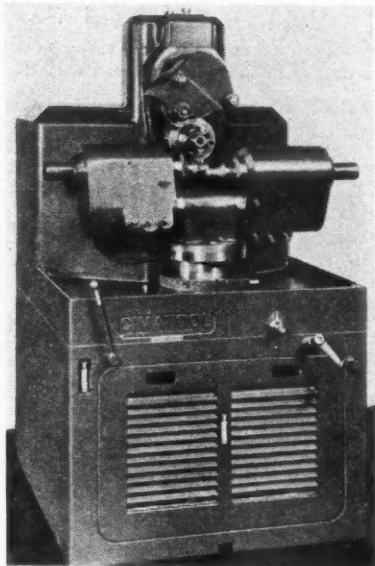


*Barnes No. 224
honoring machine.*

Cimatool Is New Burring Machine

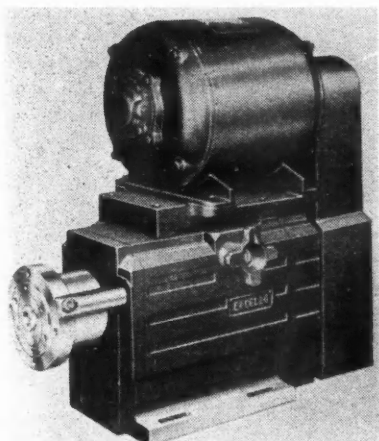
Cimatool Co., Dayton, Ohio, has developed a complete line of automatic machines for the chamfering and burring of gear teeth. The teeth for aircraft engine gears are burred over their complete contour, including the root. The burring cut need not be heavy, but it must eliminate all chance of crystallization and chipping in operation.

The Cimatool No. 200 burring machine can burr gear teeth at the rate of 1250 per minute by the use of a fly



Cimatool No. 200 burring machine.

cutter in each of two spindles. The action of the machine in general is similar to that of a hobbing machine. One of the fly cutters machines the front end of the tooth while the other simultaneously machines the rear end. Machine operation is entirely automatic and includes hydraulic clamping. A solenoid-operated instantaneous friction brake stops the machine after a complete cycle leaving the cutting tools in a position for unobstructed unloading of the work.

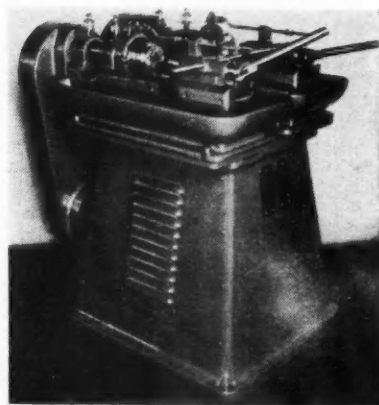


Ex-Cell-O hydraulic power unit

Two spindle threader built by the Eastern Machine Screw Corp., New Haven, Conn. Motor, pump, cutting oil reservoir, and all electrical equipment are concealed in the base.

New Hydraulic Power Unit

The new small hydraulic power unit announced by Ex-Cell-O Corp. has spindle speeds from 370 to 1590 r.p.m., and will handle drills from 3/16 in. up. (With a multiple head or speeder unit,



Uniform Results... Lower Costs with Ryerson Certified Alloys

You can reduce failures—eliminate spoilage and get better results in less time with Ryerson Certified Alloy Steels. They are from selected heats of steel that meet an ideal specification—a "specification within a specification"—that assures uniform response to heat treatment.

All Ryerson Certified Alloys are analyzed and tested in advance. Special data sheets showing exact chemical analysis, grain size, cleanliness rating, and results of actual heat treatment tests, are prepared and sent with every shipment. You know exactly what you are getting. Your heat treater does not have to test. He takes no chances. Spoilage is eliminated and sound dependable jobs of high accuracy and uniformity are secured.

Ryerson has large and complete stocks of these selected identified alloy steels. They cost no more and quick shipment is assured.

Ryerson Certified Steels also include carbon, tool and stainless steels that meet definite quality standards. They offer many advantages to steel users. Let us tell you the complete story. Write for booklet.

JOSEPH T. RYERSON & SON, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.



RYERSON

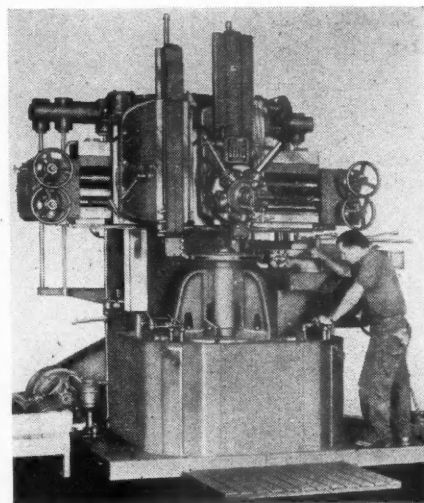
smaller drills as desired may be used.) Maximum stroke is $4\frac{1}{2}$ in., and the unit can be powered by motors up to three hp. and is capable of drilling a $\frac{3}{4}$ in. hole in steel.

The unit is used to rotate and feed a single tool or multiple spindle head on drilling, reaming, facing and other similar operations, and is used also as a prime mover for other machine units on milling, boring and other operations. After starting, the operating cycle of the hydraulic power unit is automatic: uniform rapid traverse in both directions, adjustable forward feed, and either return or positive stop dwell and return.

Bullard Cut Master Vertical Turret Lathe

The Bullard Co., Bridgeport, Conn., has developed a new Cut Master vertical turret lathe. The new line includes five sizes, 30 in. 36 in., 42 in., 54 in., and 64 in.

With the exception of the 30-in. and 36-in. sizes which alone are designed for two heads, a main turret head and a side head, these machines are designed to carry three heads—left-hand main ram head, a right-hand main turret head, and the side head. All heads and functions of the machines are pro-



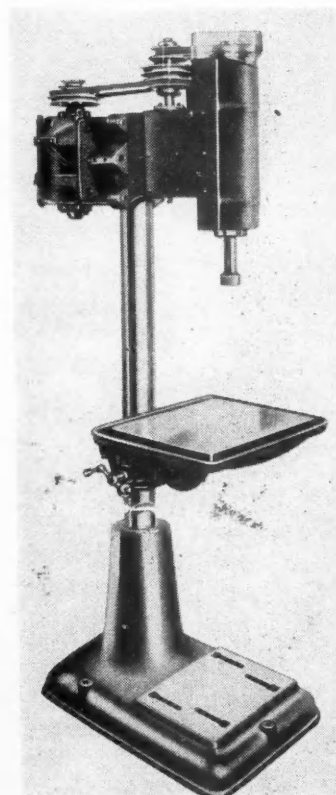
The Bullard Cut Master vertical turret lathe.

tected by interlocking and limit switches.

There are 16 changes of feeds and 20 changes of speeds, all in geometric ratio. A 25 per cent higher spindle speed range can be provided if desired.

Floor-Type Honing Machine

New product of the Honing Equipment Corp., Detroit, is the Model MMVT floor-type honing machine illustrated herewith. The head is inter-



Model MMVT floor-type honing machine.



• • • Unequalled SURFACE SMOOTHNESS and SPHERICITY

The series of lapping operations performed as a matter of course in the Strom plant give Strom Steel Balls a degree of surface smoothness and sphericity that has always been unequalled in any other regular grade of ball. Only through such unique lapping practice can extreme precision be obtained.

Physical soundness, correct hardness, size accuracy, and sphericity are guaranteed unconditionally in all Strom Balls.

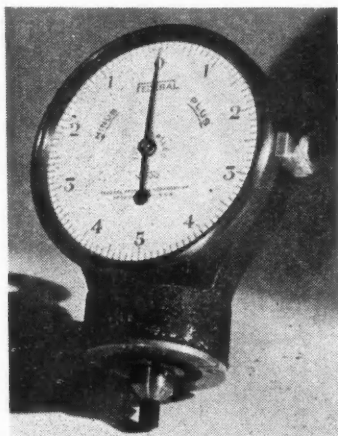
Other types of balls—*stainless steel, monel, brass and bronze*—are also available in all standard sizes. Write for catalog and prices.

Strom

STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer



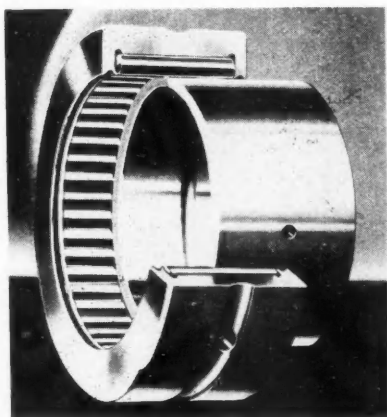
This super-sensitive type of dial indicator was brought out recently by the Federal Products Co., Providence, R. I. Other new products of the company include: a new type of bore gage, model 1201, which will measure from $\frac{3}{4}$ in. up to 14 in. and over in diameter; a self-locating two-point contact, cylinder gage (model 1200) which positively locates itself in automobile cylinders or similar bores.

changeable with the production-type bench plate and can be arranged in batteries of two or more, on a work bench or specially-designed table. This is a production machine with an adjustable swinging work table for small parts, and a work table arranged on the floor base for large pieces with small bores.

McGill "Solidend" Multirol Bearing

McGill Mfg. Co., Valparaiso, Ind., has announced a design of full type needle roller bearing, to be known as the "Solidend" Multirol, which is said to assure an increase in load-carrying capacity of as much as 12 per cent over any previous design.

"Solidend" is intended to be descriptive of the new outer race construction



McGill "Solidend" Multirol bearing.

by which rollers are held integral without the use of end washers and retaining end rings. Roller retaining shoulders are built integral with the outer race so that the possibility of accidentally bending or breaking the conventional end washers, resulting in disassembling the unit, is eliminated.

Feed Clutch Feature of New Jig Borer

The new jig borer built by Cleereman Machine Tool Co., Green Bay, Wis., is designed for jig, fixture, tool and die work, and is said to be especially

adapted for extremely accurate manufacturing, as well as for experimental work and short run production.

Twelve speeds in a ratio of 20 to one are available. These may be had in either of two ranges, and when a wider range of speed is desired a two-speed motor may be used to obtain a ratio of 40 to one.

The manufacturer stresses the speed and ease of operation of the feed clutch. A friction clutch is employed to engage the power feed. The same turnstile reverse levers that are used for hand quick-traverse are used to engage the friction feed clutch. A feed reverse, in-



ONLY LAPPING As Strom Does It CAN PRODUCE SUCH PRECISION

Strom Steel Balls possess a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Such precision is exclusive with Strom because it can be attained only through a series of lapping operations such as are standard practice in the Strom plant.

Physical soundness, correct hardness, size accuracy and sphericity are guaranteed in all Strom Balls.

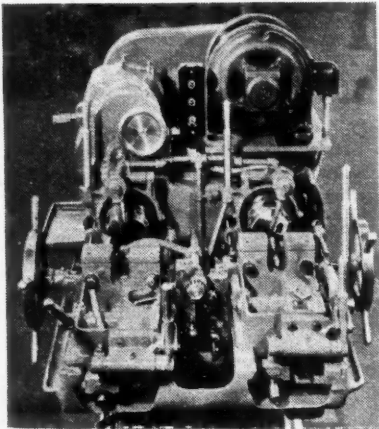
Other types of balls—stainless steel, monel, brass and bronze, are also available in all standard sizes. Write for complete details.

Strom

STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

The largest independent and exclusive Metal Ball Manufacturer



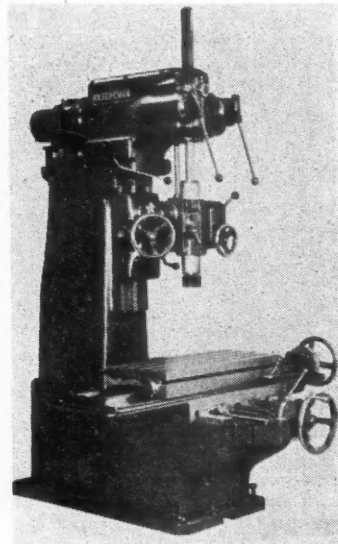
(Left) Landis special turning machine.

incorporated in the power feed, is put in operation by a hand knob in the center of the fine feed handwheel.

Bryant Machinery & Engineering Co., Chicago, is the sales division for the Cleereman company.

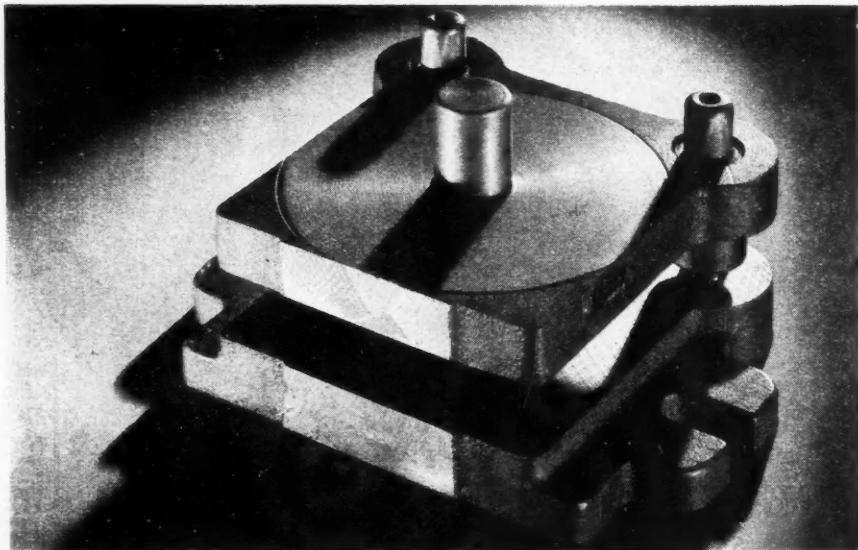
Landis 7/8-in. Turning Machine

A machine recently equipped by the Landis Machine Co., Waynesboro, Pa.,



Jig borer built by Cleereman Machine Tool Co.

Danly "SQUARE"



Precision Sets . . .

Danly Precision Guide Posts are ground and lapped to plus or minus .0001" of listed dia. Precision Bushings are ground and honed to plus or minus .0001" of listed dia.

"SQUARE" die sets in sizes from 3"x3" to 14"x14" are included in the new and enlarged Danly line of back post Precision Sets.

In addition to their value for mounting dies that are approximately square, these dies are especially useful for mounting

round dies. The additional metal provides a firm seat for dies, in which the set is machined to permit use of bumpers, or to allow stock to drop out of the press.

A new catalog contains full information on the use of these sets and the others in the new and enlarged Danly Precision line. If you have not received one write at once for your copy. All Standard Sets are stocked in 8 Danly Branches for immediate delivery.

DIE BUYERS—
Specify Danly
Die Sets
for your Dies

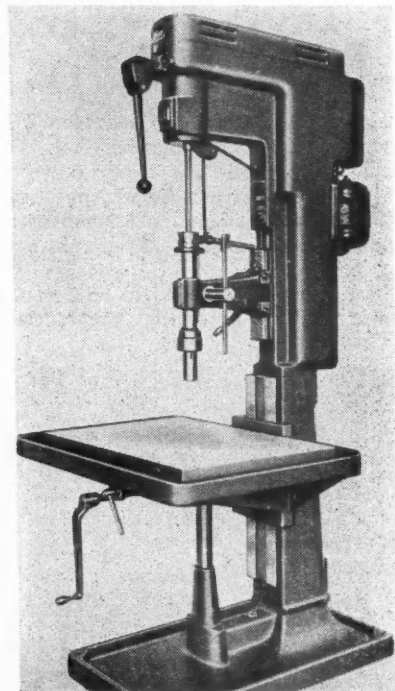
DANLY MACHINE SPECIALTIES, Inc.
2130 So. 52nd Ave., Chicago, Ill.

It will be good business for you both

DIE MAKERS—
Include Danly
Die Sets in
Your Estimates

DANLY DIE SETS and DIE MAKERS' SUPPLIES

Their Dependable Quality Means Lower Cost Stampings



A new belted motor drilling machine, with a wide range of spindle speeds and extra large table, for tool and die shop use. It is manufactured by the Avey Drilling Machine Co., Inc., Cincinnati, Ohio.

FINANCE

(Continued from page 366)

4. Some banks offer dealer salesmen a commission to bring their automobile customers to them, by-passing the dealer's own sales financing setup.

5. Generally speaking, banks do not offer the wide range of financing services offered by well-established finance companies, taking only the more profitable parts of deals.

6. A number of banks had advertised low interest rates for financing sales, but made additional charges that brought the total cost to customers above that of the usual financing rates.

In discussing these experiences, the executives pointed out that many of the finance companies had allowed bad practices to creep into their business, thus opening the door for competition from banks in their local communities.

Mr. Weller and other speakers reported that many finance companies had forced unprofitable used car deals upon dealers. This practice, it was pointed out, was immediately profitable to the finance companies involved, but they soon lost their business with the harassed dealers. A number of speakers pledged themselves to support a program for gathering more statistical and policy information about the retail sales financing business, and suggested a positive legislative program on a national scale rather than simply fighting in self-defense against restrictive legislation.

Clarence L. Landen, vice-president, Securities Acceptance Corp., Omaha, Neb., was elected president of the association by the new board of directors following the last meeting of the convention. Mr. Weller, head of Credit Acceptance Corp., Rochester, N. Y., W. W. McCarthy, Boston; L. M. Siever, Philadelphia, and H. G. Snodgrass, San Francisco, were all elected vice-presidents. The 1940 meetings will be held in Washington, D. C., it was voted.

Charles M. Schwab

(Continued from page 366)

them. When our metallurgists and chemists find out more about steels, you will see the railroads and shipping revolutionized.

"You will see steel doing the work of billions of feet of lumber. You will see steels in uses that today would be unbelievable.

"The automotive industry," he said, "has been quicker than many other users to adopt alloys—letting only a few pounds do the work of many," he pointed out.

With only two years of college back of him, he got a job as a grocery clerk in Braddock, Pa. Soon he attracted the attention of the superintendent of the Edgar Thompson Steel Works and was driving stakes on a plant expansion job. Within three years he had become the chief of the mill's engineering force.

At 21, he and his bride set up a little

chemical laboratory in their kitchen, and they worked together compounding chemicals and iron.

Advancing rapidly, he was called upon to negotiate in the great Homestead strike of 1892. He at once rectified a number of things to which the workers objected, and the labor trouble was settled within a few months. Homestead emerged as one of the greatest steel producing units up to that time, and Mr. Schwab emerged as a master of steel.

At 35 Mr. Schwab was president of Carnegie Steel Co., having turned down the vice-presidency a few years before. He came into his own as the greatest

salesman in history. Backlogs built up, but he kept selling.

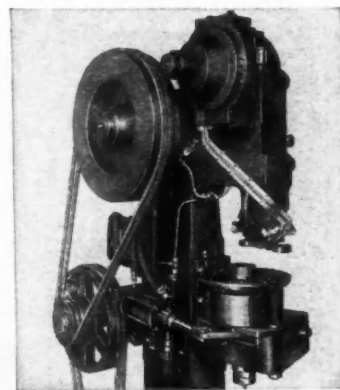
In 1900 he met J. P. Morgan and other bankers at a dinner. Mr. Schwab talked steel, and the bankers listened in amazement as he unfolded his vision. That was the beginning of U. S. Steel Co., which he headed during his 39th year. Carnegie was bought at nearly a half-billion dollars, and other plants and coal and ore mining properties were added to the huge combination.

Forty-one years old, a millionaire, a director in many corporations, Mr. Schwab "retired to putter around" the Bethlehem Iron Co. in 1904. The \$15,-

(Next page, please)

3240 solid rivet joints per hour

attaching cushion springs to driven clutch plate assemblies. There are 18 rivets in each assembly, making 180 assemblies per hour. The plates are indexed automatically, two rivets being fed and set at a time. The riveting action causes the rivet metal to flow—accomplishing a completely filled hole with no flashing. Automatic—high speed solid rivet setting—neat, balanced "coined" heads.



the RIVITOR

is maintaining similar automotive production schedules in the manufacture of

✓ tappets

✓ radiators

✓ seat racks

✓ window frames

✓ horn bracket assemblies

✓ instrument board panel assemblies

this is a **TOMKINS-JOHNSON** product

Send samples of your riveting jobs to 613 N. Mechanic Street, Jackson, Michigan. No obligation. Our representative in your territory will be glad to go over your problems with you. T-J products also include . . . Air and Hydraulic Cylinders . . . Remote Control Systems . . . Rotating Chucks and Cylinders . . . Clinchers . . . Special Equipment . . . Brownie Coolant Pumps . . . T-J Die Sinking and Milling Cutters.

000,000 property was valued, in terms of assets, at more than \$700,000,000 in 1930, and reported gross sales of more than \$250,000,000 for that year.

"Impossible" tasks, such as the wartime production of ships were a delight to Mr. Schwab. A few years ago he told a group of friends about an early joust with a southern farmer whose land separated Bethlehem properties. The farmer had turned down several envoys from Bethlehem, when Mr. Schwab invited him to his office. He sent his special railroad car to bring him up.

Once in the office, Mr. Schwab asked his associates to leave the two together.

Seated on the couch in the office, Mr. Schwab began to ask the farmer about the crops, his family, and his experiences.

At the end of about half an hour, the farmer stopped the interview with "You can have the farm, Mr. Schwab, but thank God I'm not a woman."

Denying that either he or the company had made huge profits from war contracts in a federal claim for \$19,654,856.72, the government's special master dismissed the "unconscionable profits" action, and awarded the Bethlehem Steel companies \$5,666,154 additional on one of the contracts involved in the case.

Probably no man in America knew as many important world figures as did Mr. Schwab. An excellent whist player, he tutored crown heads of Europe, business associates, and famous peoples in all walks of life on the intricacies of the game.

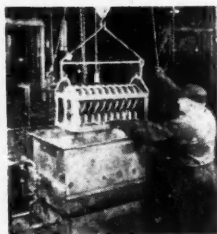
In 1933 he again tried to lighten his load, and resigned practically all of his official posts except the chairmanship of Bethlehem. But he could not give up his work in spite of protests from his doctors and associates.

The death of Mrs. Schwab early this year was a severe shock to him. Soon after he closed his mansion on Riverside Drive, New York, put his homes in Bethlehem and Loretto, Pa., his birthplace, on the market, and moved into a Park Avenue apartment.

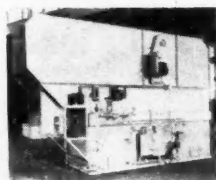


1940 CLEANING METHODS

For Finishing and Heat-Treating



Vapor-slush type Detrex Degreaser used with electric lift to clean parts after oil quenching.



Conveyorized 3-dip Detrex Degreaser used for cleaning prior to painting, plating or inspection.

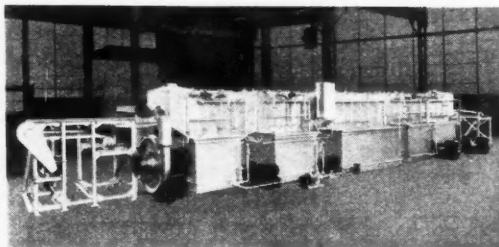


Timed to your 1940 production are the Detrex engineered cleaning equipment and solvents.

Your requirements for fast, flexible and economical cleaning will be met by a Detrex Degreaser.

Using stabilized safety solvents—either "Perm-A-Clor" or "Triad"—the metal parts or assembled products emerge clean, warm and dry, immediately ready for painting, plating, heat-treating or inspection.

Complete information on the Detrex equipment or solvents best suited to your particular requirements is yours for the asking. Or better yet, let a Detrex engineer consult with you.



A typical Detrex spray installation consisting of alkali washer, rinses, chromic acid, Bonderite, and air blow-off.

DETROIT REX PRODUCTS COMPANY

Engineered Solvent Degreasing and Alkali Cleaning
13001 HILLVIEW AVENUE • DETROIT, MICHIGAN
Branch Offices in Principal Cities

BARRIERS

(Continued from page 340)

The study further reveals that some state statutes enable their political subdivisions, counties and cities, to tax truckers. Some states, through various exceptions to fees, encourage the merchant trucker to come into the state to buy, but not to sell.

In addition to the intangible burdens and requirements of the various state laws, motor vehicles are also subject to the oft discussed "ports of entry"—tangible barriers erected by the states. These are described as one of the most serious exercises of the state's inspection powers devised since the birth of our Constitution. Twelve states provide for some form of port of entry.

Only the salient features of each port of entry law were indicated in the report. It was emphasized that when it is remembered that Kansas has 66 such ports, Oklahoma 58, Nebraska 31 and New Mexico 22 one can readily see what practical difficulties result, not only upon motor vehicle transportation itself, but upon the commodities and products transported.



Charles E. Webster, associated with Canadian activities of the Timken Roller Bearing Co., Ltd., Toronto, Ont., for 20 years, has been appointed general manager.

H. N. Ross has been made Eastern Indiana sales manager by International Harvester.

Lee C. Carlton, formerly sales manager of the American Bosch Corp.'s western division, has been appointed manager of the company's newly-created sales and engineering division and will make his headquarters in Springfield, Mass. Foster N. Perry has been named sales manager of the western division; Frank Oberle is now sales manager of the eastern division; and,

Maynard A. Fowler is sales manager of the newly-formed Pacific Coast division.

R. Carson Dalzell has been appointed technical advisor to the Baltimore division of Revere Copper & Brass, Inc.

H. C. Mougey, head of the general chemical department of General Motors Research Laboratories, has been named technical director of the laboratories to succeed Dr. Frank O. Clements, who retired after 19 years with the department. Mr. Mougey was one of the first five men to join Charles F. Kettering and Clements when the old Dayton Engineering Laboratories were formed in 1917 and which were taken over by General Motors in 1920.

J. Franks, formerly assistant to the vice-president of White Motor Co., has been made general service manager.

L. F. Shoemaker has been appointed a sales manager of the automotive and industrial division of The Buda Co., Harvey, Ill.

John Lyon Collyer has been elected president of The B. F. Goodrich Co. Mr. Collyer was formerly joint managing director of the Dunlop Rubber Co., Ltd., England.

DIE CASTING

(Continued from page 311)

such changes in design as the stylists decree. One detail in this connection is the use by some makers of exterior handles which are set into the belt molding and from some angles appear to be a part of it. This is in line with the trend toward cleaner exteriors with a minimum of projecting parts, those projections which are necessary being made inconspicuous.

Study of accompanying illustrations and the descriptive matter in captions for these will reveal other details which need not be amplified here. It will be noted, however, the design of the die castings exposed to view in service is not only pleasing in itself but results in good blending with adjacent parts. The highlights of plated castings attract attention and the bright surfaces provide accents which are pleasing in combination with any color selected for adjacent sheet metal surfaces.

Machinery Practice

Because of the dimensional accuracy and smooth surfaces characteristic of die castings, relatively little machining is required and that which is necessary involves only light cuts. Although the machining operations are all simple, considerable ingenuity is displayed in tooling and the cost of machining is minimized by good design of the tools and fixtures employed. Several setups, employed in most instances by different die casters, are here illustrated and described, production rates being given where data in this regard have been furnished.

All die castings come from the die with a flash formed at die partings and where movable cores and slides are required. Flash is nearly always removed

by the die caster and he often performs such other machining operations as are required. An increasing number of setups for removing flash in punch presses is to be noted and since through cored holes have a flash which must be removed anyway, it is sometimes economical to punch the holes when they are required in thin sections rather than complicate the casting die with cores, and this practice is now followed extensively, especially with the zinc alloys, which are quite ductile and are not subject to cracking or distortion under the punch if properly supported. Die castings required in large quantities are often produced in dies with several cavities and

there is an increasing tendency, when conditions permit, to provide dies for flash removal designed to clear the flash from all the castings on a gate in a single stroke of the press. A case in point is found in the Doehler Toledo plant, where four halves for Delco horns are cast on one gate and the flash removed from all four in a punch press equipped with a die which shears the flash from all the castings at once and, of course, with considerable economy as compared with using a single-cavity trim die.

Details concerning typical and unusual setups for machining are given in captions for the illustrations shown.

THE SENSATION OF THE MOTOR INDUSTRY!



- ★ 25% LESS WEIGHT
- ★ 30% FEWER PARTS
- ★ 13 IMPROVED FEATURES
- ★ REDUCED DIRECT LABOR COST
- ★ PROVEN PERFORMANCE

Engineers Acclaim Amazing New ATWOOD Clutch (THELANDER)

Forging rapidly to the front since its introduction in 1933, this new Atwood Spring-Loaded Clutch has won the hearty acclaim of America's leading automotive engineers. Some applaud its silky-soft cushioned engagement . . . others point to its turbulent ventilating action . . . still others like its minimizing of pedal pressure and its reduction within the unit itself of friction and pivot point deflection. All are in favor of its economy, through reduction of weight, parts and direct labor costs. But you be your own judge and jury . . . send us your blueprints . . . let our skilled engineers develop a custom-built unit to test right on your own product. Do it now!

NEW "ATWOOD" CONSTANT PRESSURE LOCK-UP TYPE CLUTCH—with patented resilient factor (actually "Spring Action") that automatically builds up pressure to compensate for decrease in pressure due to wear. For heavy-duty tractors, combines, and Diesel engines. Write or wire for details.

Another ATWOOD Product
AUBURN MANUFACTURING CO. AUBURN INDIANA
 DIVISION OF ATWOOD VACUUM MACHINE CO., ROCKFORD, ILLINOIS
 Builders of Automotive Equipment for Over 20 Years

Buick Advances to 1940

(Continued from page 303)

front surface of the insulating material is not vulcanized to the metal on the inside of the mounting.

Front mountings have been set at right angles to the rotational movement of the powerplant, differing from last year's mountings in that respect. The transmission steady-rest mounting is of the same design as the rear engine mountings. It takes only forward and backward thrust, and is free of torsional loading and powerplant weight.

Clutches remain the same, a single-plate corrugated-spring type being used on the 40 and 50, a conventional single-plate clutch on the 60, 70, 80, and 90. On the 40 and 50 the clutch facings are new and have an additional row of rivets in the driven plate. Horse-shoe-shaped spring-steel pads have been added to the release-bearing retainer to prevent yoke pins from cutting the retainer. Clutch and brake pedals now are fitted with bronze bushings.

Generator capacity has been stepped up to 33 amperes, hot, and 42 amperes, cold. All models now have voltage-current regulation.

A simplified, vacuum-controlled starting motor switch is used on all models. It prevents clashing of the starter gears after the engine has started. An important feature of the switch is the use of wiping contacts of large contact area.

Very rigid chassis frames have been developed for the 1940 Series 40 and 60 cars. Side rails are $\frac{3}{4}$ in. deeper at the rear kick-up, $1\frac{1}{2}$ in. deeper at the dash. In addition, the stock thickness of the side rails has been increased. Another improvement is an increase in depth at the intersection of the X-member.

Due to the larger and wider bodies on the 50 and 70, these chassis have been fitted with entirely new frames. While of the same general design, these frames have box-section side rails and wider X-member flanges. From the dash to the rear, these frames are wider and have parallel side members. Series 80 and 90 frames remain unchanged, except that they have strengthened front and engine cross members.

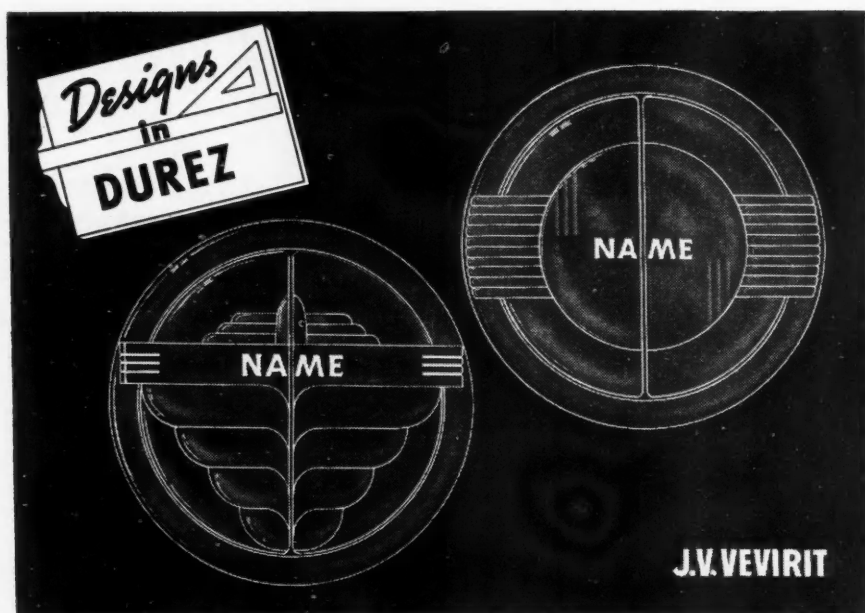
Many changes are incorporated in the shifting mechanism. The control lever now is a rod of small diameter which connects with a small ball-socket at the inner end. Both shift lever and control rod are on top of the steering column. The selecting movement is effected by a rod within the hollow control shaft, and the shift is made by rotating the control shaft. Both cross-over and shift linkage now is of the positive type, the cable formerly used having been discarded.

Transmissions on Series 60 and 70 are identical in design with those on Series 80 and 90, accommodating the universal joint and torque ball and retainer at the rear end. Series 40 and 50 transmissions now are fitted with roller bearings on the countershaft. All transmissions have the same type of rear bearing retainer.

Brakes have been increased in size to 12 by 2 $\frac{1}{4}$ in. on the 60 and 70, and to 14 by 2 in. on the 80. Composite brake drums are used on the 40, 50, 60, and 70; cast iron on the 80 and 90.

Tires are 6.50/16 on the 40 and 50; 7.00/15 on the 50 and 60; 7.50/16 on the 80 and 90, with four-ply on the 80 and six-ply on the 90. This represents an increase in tire size on the 80.

Front suspension incorporates some important modifications. The principal change on the 40, 50, 60, and 70 models is that the suspension system has been rotated backward 4 deg., which is said to increase responsiveness to steering and to reduce squeal on turns. The lower control arms are assembled integrally with the spring-seat, bumper and stabilizer-link brackets, and inner shaft. New composition bushings with a steel shell are used in the inner ends of the lower arms on all series except



Heater designs in molded Durez by J. V. Veirit

NEW TREND IN HEATERS

This year, automobile interiors are coming in for special attention by designers. Particularly under dash space where the trend is toward a simpler, more orderly appearance of radios, heaters, controls and similar fittings.

These ideas for heater housings molded of lustrous Durez plastics are in step with this trend—if not a step ahead of it! They're not only smart and colorful, but

extremely practical. Besides beauty, they offer the advantages of durability, light weight and easy production. Each part, including hinged doors, can be molded in a single, swift operation.

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| • Distributor heads | • Rotors | • Dashboards |
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| • Control knobs | • Spark Plug shields | • Radio grilles |

DUREZ

PLASTICS THAT FIT THE JOB

DUREZ PLASTICS AND CHEMICALS, INC.

the 80 and 90, which are fitted with threaded steel bushings. Rubber seals are used on the outer ends of the control arms on all but the 80 and 90. On the latter, rubber seals are found at the inner ends of the lower control arms. Threaded bushings are used in the lower control arms on all series.

Front shock absorbers are double-acting on all models; they are inertia controlled on the 80 and 90. Rear shock absorbers have been relocated on the Series 40, 50, 60, and 70, where they are now mounted on the rear brake backing plates instead of on the frame.

Major changes have been made in the rear axle and suspension of Series 40, 50, 60, and 70. Torque tube and propeller shaft now are in one-piece with the universal-joint housing directly back of the transmission. Rear springs are of larger i.d. ($5\frac{1}{2}$ in.), which permits a shorter spring height. In addition, the springs are nested about 3 in. closer to the rear-axle centerline, and above it. These changes have produced a marked reduction in the static load imposed on the torque ball.

Relocation of the rear coil springs permits the use of a longer transverse radius rod on the 40, 50, 60, and 70. The front stabilizer is continued, and on the models mentioned above it is supplemented by a light stabilizer at the rear.

Rear axles have been altered to accommodate the new torque-tube arrangement, and now feature a flanged differential carrier, the latter having short bearing pedestals, for greater rigidity, on the 40, 50, 60, and 70. To compensate for the increased length, propeller shafts on these models have been enlarged from 2-in. to $2\frac{3}{4}$ -in. diameter, while the torque tube diameter has been stepped up from 3 to $3\frac{3}{4}$ in.

Front- and rear-pinion bearings on these models are larger and are now interchangeable with those on the 80 and 90. Torque-ball and retainer design is similar to that of the 80 and 90, with a malleable-iron ball and stamped-steel inner and outer retainers. Contacting surfaces on the retainers are copper-plated; on the ball, tin-plated.

Standard gear ratios are as follows: Series 40 and 50, 4.40; Series 60 and 70, 3.90; Series 80, 4.182; Series 90, 4.55. "Economy ratios" are offered on two series: Series 40, 3.9; Series 60, 3.615.

Chryslers Are Redesigned

(Continued from page 307)

designed to slide under the body in case the bumper is struck.

The new body provides greater interior room, having wider front and rear seat cushions. The distance from the rear-seat back to the back of the front seat has been increased to provide more leg room.

Safety signals are incorporated in the speedometer and all gages, which give a warning in case of low fuel supply, no oil pressure, high temperature of

cooling water, or faulty generator operation. At night the safety signal speedometer shows the speed range in which the car is being operated.

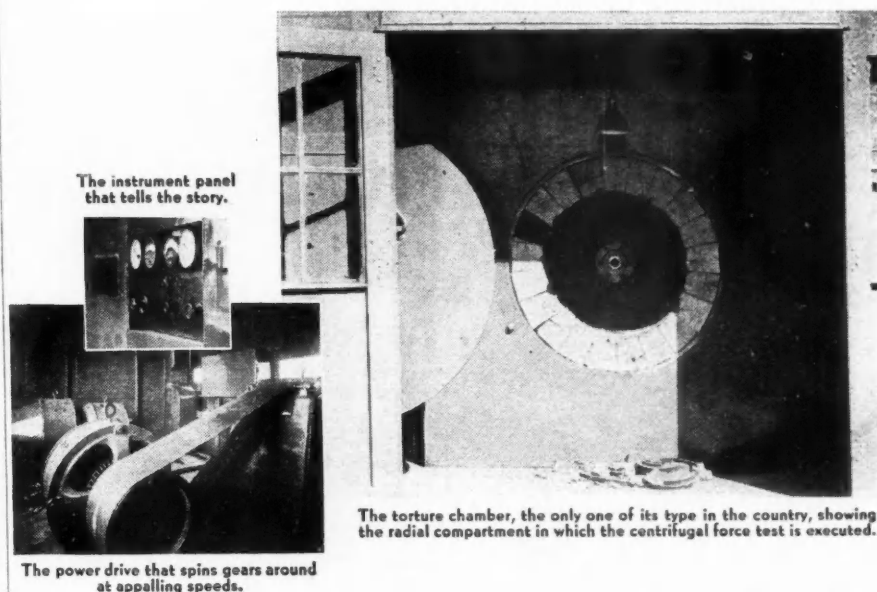
Doors can be easily locked. Front doors have remote control locks operated by the inside door handles. Rear doors in four-door sedans have push-button locks that guard against accidental opening.

Tire sizes on the new Chrysler models are as follows: Royal and Windsor, 6.25/16 (6.50/16 on the seven-passenger models); Traveler, 6.50/16; New Yorker and Saratoga, 7.00/15; Crown Imperial, 7.50/15 with Life Guards.

Polk Places August New Car Sales at 181,000

The nation's increased activity in new passenger car registration continued in August, according to R. L. Polk & Co. tabulations from 26 states which show 40.18 per cent heavier registration than in August a year ago.

On the basis of these partial reports, the Polk company estimates total national sales of new passenger cars in August at 181,000. Truck sales for the entire country in the past month are estimated at 42,700.



The instrument panel that tells the story.

The torture chamber, the only one of its type in the country, showing the radial compartment in which the centrifugal force test is executed.

The power drive that spins gears around at appalling speeds.

TORTURE TECHNIQUE

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PARTS TESTED FOR CENTRIFUGAL FORCE TO THE POINT OF COLLAPSE

Scientific torture—that's the test for centrifugal force given Spicer parts—another reason why Spicer quality and performance does not "just happen."

In this testing apparatus, Spicer parts are driven at terrific rates of speed—six or seven thousand r. p. m.—then faster and faster until they shatter under the tremendous force. It's because Spicer demands fool-proof evidence of the full

strength of its parts under the severest strains—to be sure they are fully equipped to withstand stresses many times greater than actual use.



Clutch flywheel housings are among the parts given this test.

That's the proving ground of the design and the safety of Spicer units—of the development of metals of super-strength—of the long, satisfactory service in Spicer quality. No wonder more and more equipment users are specifying Spicer products.

Spicer Manufacturing Corporation • Toledo, Ohio

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TRANSMISSIONS

SALISBURY
FRONT and REAR
AXLES

SPICER
UNIVERSAL
JOINTS

PARISH
FRAMES
READING, PA.



PLASTICS IN 1940 CARS

(Continued from page 314)

plane fuselages have been molded in sections, each section consisting of one longitudinal half of the fuselage. These sections are formed from several layers of resin-impregnated wood veneer¹ which are jointed into a self-bracing unit with tensile, impact and compressive strengths comparable to conventional structures.

While the principle of this method has not yet been applied to fabricating automotive bodies in this country, it

should not be overlooked in appraising the future uses of plastics in automobiles. German experiments looking toward fabrication of complete bodies in this way have been reported.

The large injection molding machines previously mentioned have been used principally in producing automotive body parts. One of the most interesting examples of the work of this type of equipment are the plastic-over-metal instrument panels and glove-compartment

doors on the 1940 Chrysler. The production steps on these parts are relatively few. Medium-gage metal stampings are made with tolerances held within liberal bounds. These stampings, with no finishing whatever, are the base for the complete molding. Just as they come from the stamping press, they are inserted in the injection mold. The bottom surface of the metal is flush with the bottom of the female mold. The mold is then closed and clamped under hydraulic pressure. The upper part of the injection mold, into which surface designs of the part are worked, has a clearance of approximately $\frac{1}{8}$ in. from the stamping. Into the cavity thus formed, cellulose acetate in a flowing state is injected through runners from four heating chambers simultaneously. After a brief lapse the mold is automatically opened and the part ejected. The stamping has been given a tough, resilient coating of plastic in a close union with the metal.

The same equipment has made possible experiments in injection-molded steering wheels. Standard practice to-

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LAMINUM
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT



Band sawing of cast resin sheets is done on standard wood-working equipment. (Photo courtesy Catalin Corp.)

day for the production of automobile steering wheels calls for compression molding in semi-automatic hydraulic presses using thermoplastic molding powders. It is apparent that the injection process offers several potential advantages for the production of this type part. In compression molding thermoplastics the mold must be brought to a heat high enough to plasticize the powder and after the cavity has been filled the mold must be chilled by circulating water to harden the steering wheel sufficiently to permit its removal from the mold. Since in injection molding the plastic is held at a constant temperature in the heating chamber and the mold is constantly chilled, a substantial reduction in the time cycle is possible. While commercial production does not yet enable adoption of these

¹ Laminated materials made in this way must be distinguished from plywood in which synthetic resins are used as glue. In this case the wood is thoroughly impregnated before bonding.

wheels in 1940 models, their use in 1941 cars is expected.

Further experiments in injection-molded automobile parts are directed toward headlight shells and window reveals. While one-piece molded window trims have been used abroad for some time, their development for use in American made cars is recent. Production in capacity adequate for use in several lines is anticipated in the near future. The molded headlight shell is made of a cellulose acetate compound that is said to have sufficient resistance to weathering and the heat of the lamp to withstand rigorous outdoor conditions.

Mechanical and Electrical Applications

Early impetus was given to the plastics industry by the demand of electrical engineers for satisfactory insulating materials. Indeed, before the development of more decorative plastic materials, the electrical properties of plastics provided perhaps the most important market for these materials.

An interesting example of the way in which molded plastics have been tested in use over a period of time with a steady increase in the number of parts used in succeeding models is to be found in the experience of one magneto manufacturer. The first model of this maker to use molded materials had two parts of plastic, a coil jacket and terminal post, in both cases used for insulating purposes. The next model used molded phenolic coil jacket, distributor cap, gear housing and distributor arm. The gear housing in this case was adopted to avoid the corrosion caused by ozone on the metal part formerly used. The use of plastics also cut weight and improved operation.

A complete redesign for the next model added more molded parts, includ-

ing a condenser housing which served also as a terminal post and anchor for the breaker spring. The use of this piece permitted a more compact, simpler and more efficient arrangement of the magneto interior. Succeeding models for various uses include 22 all molded parts. In this way the manufacturer has been able to obtain better design and performance, lighter weight and elimination of a number of parts without sacrifice in cost.

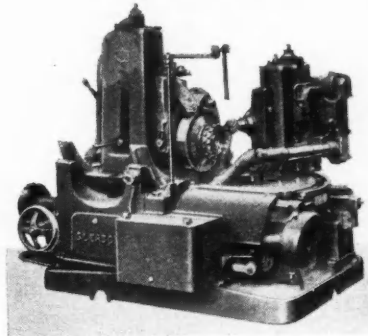
The familiar molded laminated timing wheels and similar parts requiring toughness, silent operation, insulation and strength continue to be used. Improved methods of formulation and

fabrication continue to increase their adaptability to automobile design.

Finishing Operations

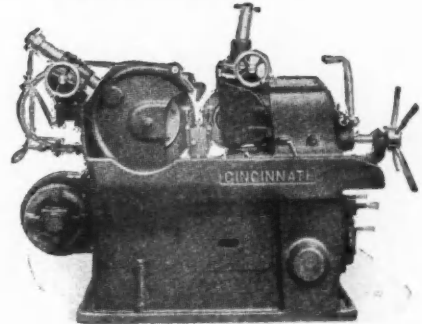
Regarding the necessity of finishing operations on plastic parts there is occasionally a certain amount of misapprehension. It is sometimes thought that molded pieces come from the press finished and ready for assembly. This, unfortunately, is not always the case. Molds made in two halves mean parting lines, and parting lines mean fins. These fins, or flash as they are termed, must be removed and the remaining surface finished. Often proper mold design can reduce the necessary finishing by arranging that flash occur at sharp cor-

USED and REBUILT MACHINE TOOLS



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Gleason Spiral Bevel Roughers, 15".
Gleason Hypoid Generators, 15".
Gleason Straight Bevel Generators, 11".
Gleason Mfg. Straight Bevel Generators, 8".
Gleason Bevel Generators, 6".
Gleason Spiral Bevel Burnishers, 15".
Gleason Combination Testers and Lappers, 18".
Gould & Eberhardt Mult. Spindle Roughers, No. 36BM.
Gould & Eberhardt Mult. Spin. Roughers, 24"x8".
Gould & Eberhardt Roughers, No. 36ST.
Gould & Eberhardt Hobbers, No. 18H.
Gould & Eberhardt No. 12HS Mfg. Hobbers.
Gould & Eberhardt No. 16HS Mfg. Hobbers.
Barber-Colman Hobbers, No. 12.
Barber-Colman Hobbers, No. 3.
Barber-Colman Double Overarm Hobbers, No. 12.
Brown & Sharpe Cutters, No. 3H.
Cleveland Rotary Spine Hobbers, 8 spindles.
Lees Bradner Automatic Generators, No. 5A.
Lees Bradner Generators, No. 5AC.
Lees Bradner Mfg. Generators, No. 2.
Lees Bradner Prod. Hobbers, No. 1.
Cincinnati Burnishers, 10".
Cross Tooth Rounding Machine.



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Cincinnati Saddle Type 8"x18".
Cincinnati Plunge Cut 12"x18".
Landis 6"x18", 6"x30", 10"x24", 10"x36", 12"x52", 12"x72".
Landis Hyd. 6"x30", 8"x30".
Landis Camshaft, 10"x36".
Norton 6"x32", 10"x18" and 10"x36" Type BA, 10"x50", 10"x72", 14"x36", 14"x72".
Bryant hole, No. 3, No. 12, No. 18.
Bryant Hole & Face No. 12A.
Heald Internal No. 50, No. 60, No. 65, No. 70, No. 75, No. 85.
Heald No. 72.
Heald No. 72A-3 "Gage-Matic".
Greenfield "Hydroll", No. 52.
Giddings & Lewis "Teromatic" No. 11.
Rivett Internal No. 103.
Brown & Sharpe Univ., No. 2, No. 3, No. 5.
Cincinnati Univ. 16"x48".
Thompson Univ. 10"x36".
Heald Rot. Surf. No. 20, No. 22, No. 25A, No. 255.
Pratt & Whitney Rot. Surf. 8".
Blanchard Vert. Surf. No. 16, No. 16A, No. 10.
Pratt & Whitney Vert. Surf. 14", 14" Mod. B.
Abrasive Surf. No. 3, No. 5, No. 33.
Badger Surf. No. 8.
Brown & Sharpe Surf. No. 2.
Diamond Surf. 84", No. 4, Type F.
Gardner Surf. No. 1, No. 96-30" Hyd.
Norton Type G Surf. 6"x10"x36".
Reid Hyd. Surf. No. 4.
Wilmarth & Morman Surf. No. 78.
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This is just a representative list of the GRINDERS and GEAR MACHINES we have in stock available for immediate shipment. We have a large stock of DRILLS, LATHES, MILLERS, PLANERS, SHAPERS, POWER PRESSES, FORGING EQUIPMENT, Etc.

Send for our No. 39 Stock List

LOUIS E. EMERMAN & COMPANY
1765 ELSTON AVE. CHICAGO, ILL.



Automobile door handles made by injection molding Tenite over metal cores. In this type design, the metal adds strength to the color, appearance and better feel of the plastic.

ners where removal is relatively easy. Or, the parting line can be arranged to come in grooves, later covered in the final assembly.

With injection moldings the problem of flash is not so serious. Since the mold is completely closed before the material enters and pressure applied, there is less chance of the material flowing between the flush surfaces of the mold lands. While this tends to reduce the finishing needed, injection moldings have sprues formed by material hardening in the gates and runners connecting the mold cavities with the injection nozzle, giving rise to a problem of their own. As a rule, unspe-

cialized, general-purpose equipment is used for the removal of flash and sprues and improvement of surface finishes. For large-scale production mechanical presses exerting sharp quick blows,

under low pressures, are sometimes used. There are limitations to this method, in that the design of the part must be such that flash occurs only where it can be removed with a straight downward stroke. It also necessitates the manufacture of a special die which may not be justified.

Resort is often had to hand operations assisted by small belt sanders, buffing wheels, grinders and hand files. Operations of this type may be carried on with jigs to hold the piece while unwanted projections are filed off by hand. Compressed air is sometimes used to accomplish the same end. In both cases the pieces are then buffed or polished to bring them to a finished state.

With small parts, where the flash is rather thin and readily removable, tumbling barrels are used to good advantage. This is equipment of a simple type, consisting of hexagonal or sexagonal barrels rotated at 20 to 70 r.p.m. With phenolic materials, cycles of from three to five minutes are used to remove flash while parts of cellulose material require longer cycles up to six hours. Tumbling is also often used to improve surface finish. In this case, ashing compounds of various degrees of fineness are used.

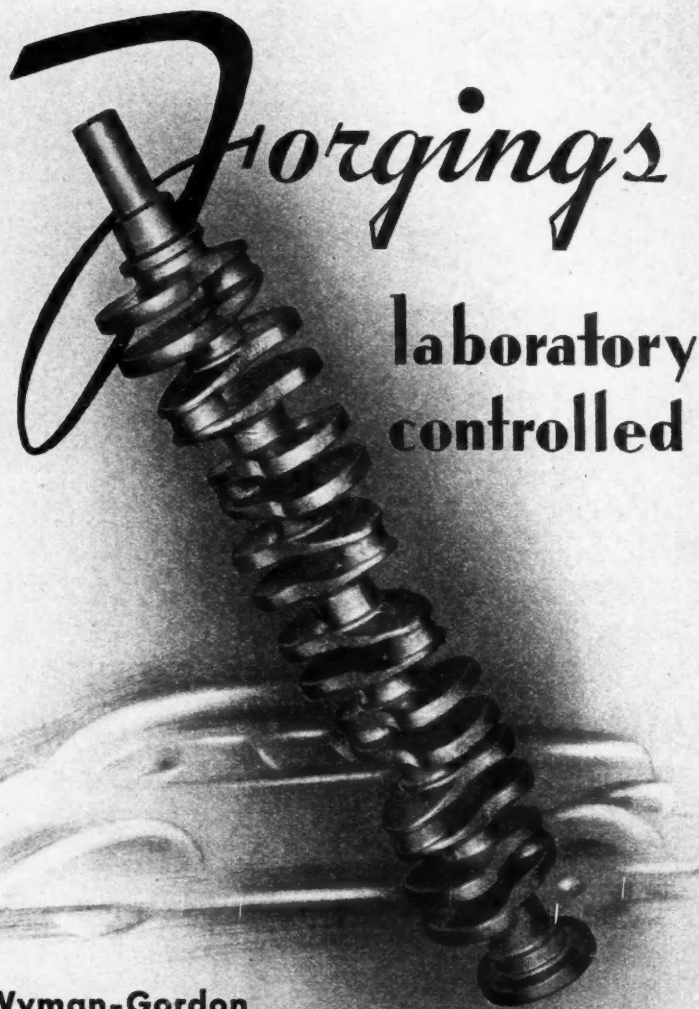
The removal of sprues on injection-molded pieces is also a hand operation. In designing injection molds, a narrowing of the runner as it enters the mold cavity can be arranged to provide a weak spot at the junction of the sprue with the piece. The pieces may then be separated by hand if they are not broken apart as they drop from the mold. Even in this case however, small projections may be left which are removed on a centerless grinder, belt sander or by buffing.



Tube and rod stock phenolic laminates are adaptable to high-speed automatic screw machine production. Large volume, and close tolerances are thus possible. (Photo courtesy Synthane Corp.)

Characteristics of Some Newer Plastic Materials

	Polystyrene	Acrylic Plastics	Transparent Molded Phenol-Formaldehyde
Type	Thermoplastic	Thermoplastic	Thermosetting
Appearance	Transparent	Transparent (water-white)	Transparent (yellow)
Forms	Molding Compound	Cast forms Molding Compound	Molding Compound
Color possibilities	Unlimited	Unlimited	Amber, ruby, green, mottled
Machinability	Poor	Good	
Specific gravity	1.05-1.07	1.18-1.19	1.27
Tensile strength	8,000 lbs. per sq. in.	7000-8000 lbs. per sq. in.	8000 per sq. in.
Impact Resistance	0.16-0.25 ft. lb.	0.3-0.5 ft. lb.	20 ft. lb.
Power factor 60 cycles	.0003	5-6%	.06



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are under laboratory control from raw material to finished product. That's why they are always guaranteed forgings.

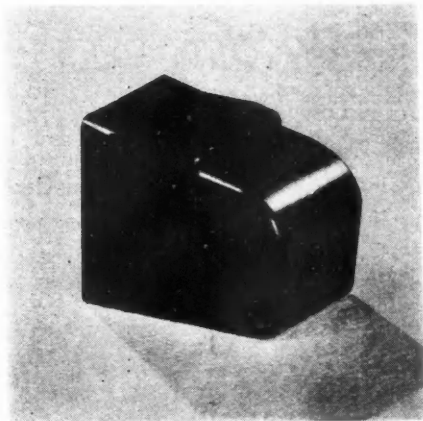
WYMAN-GORDON
GUARANTEED FORGINGS
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Finishing Rough Resin Castings

During the past few years increasing importance has been given to rough resin castings which must be finished and polished for use. In this case the castings are made in inexpensive lead or glass molds, which may be destroyed if necessary after each casting. In this way, undercuts and unusual shapes are made possible.

In these cases, the first step is the casting of the material after a complete cure has been effected. The parts are knocked out by air-guns or by hand. The rough casting at this stage is only of approximate dimensions, and lacks good surface finish. The next operation is a removal of rough edges and protuberances by turning, sanding or grinding. Ashing on rag wheels follows, after which the pieces are buffed on a wheel with compound, followed by final polishing on a dry wheel.

To attach such a finished part to metal standard or shafts, swagging by heat is the usual practice. The piece is softened somewhat by immersion in warm water, or in a steam autoclave. Then the metal part, usually heated also, is forced into the plastic. On cooling the metal and plastic are in permanent, firm union. Examples of this type of fabrication are to be found in the colored radiator ornaments and parking lights tipped with colored balls or figures.



Graphite-filled Bakelite phenolic molding material is used in this door check bumper. Wear on the part continually brings new graphite to the surface, providing permanent self-lubricating service.

Since both laminates and cast resin materials are produced by the manufacturer in a fully heat-cured condition,* thus obviating the possibility of further heat-pressure fabricating, the usual means of production of automotive parts from these materials are machine tools. Since fabrication of such parts is relatively simple and since in many cases the total production of identical parts is rather small, the machines are generally of general-purpose type. Such equipment are of the types developed for wood and metal working, and machining practices follow those in use

* Reference is had to phenolic materials.

Equipment Used in the Molding and Fabricating of Plastic Materials

Compression Molding

Hydraulic and mechanical pressed (Automatic, semi-automatic, hand transfer types. Self-contained or line feed.

Pumps, accumulators, controls, etc.

Preheating ovens, plates and tables

Tabletting (Preforming machines
Scales and automatic weighing machines

Injection Molding

Injection presses

Pumps, controls, etc.

Scrap grinding machines

Machining

Saws, drills, millers, lathes, automatic screw machines, automatic abrasive forming machines

Abrasive cut-offs, hydraulic slicing machines
Mechanical, punch and die presses
Autoclaves, steam plates, etc.

Finishing

Wheel, centerless and belt grinders and sanders

Buffing wheels

Tumbling barrels



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A.S.M.
Convention

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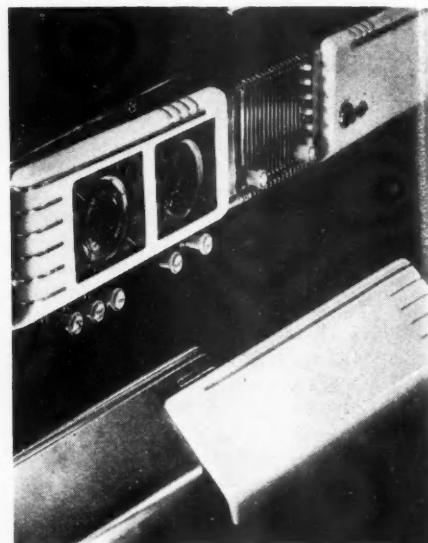
BLISS & LAUGHLIN, INC.
HARVEY, ILL. BUFFALO, N.Y.
Sales Offices in all Principal Cities

with these materials, with modifications made necessary by the properties of the particular plastic being machined.

In machining laminates, for instance, wood and metal machine tools are used. Circular saws, with carbon steel blades without set, running at speeds about 13,000 ft. per min. are applicable for cutting lengths of material from tubes, rods, bars and sheets. Chipping in this operation can be prevented by proper blade height and sharp tools. Cutting may also be carried out with band saws, running at speeds from 5000 to 8000 ft. per min.

Sawing often precedes further machining such as drilling, threading, tap-

ping or punching. Thus, in a part consisting of a short tube, with threading at either end and a number of holes through the walls, the stock will first be cut into proper length, then passed on to other machines which thread, punch or perform any other operation to finish the part. In drilling, several precautions are necessary. The holes should be backed up to insure a clean cut, and if drilling in the direction of the laminations is called for, side pressure, applied by clamps or vise is necessary to prevent delamination and splitting. Maximum drilling speed is 400 ft. per min. In tapping operations, speed must be held under 200 ft. per min.

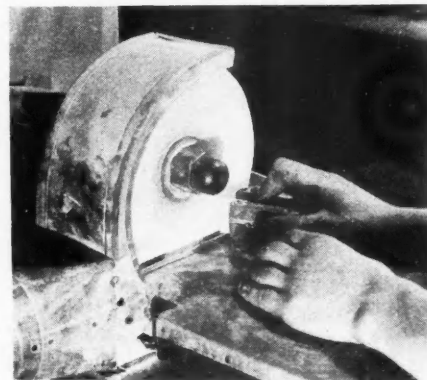


Rich, lustrous appearance is added to these Chrysler instrument and glove compartment door panels by injection molding plastic over metal stampings. The stampings, 16" by 7", are covered with a smooth, firmly-joined coating of plastic in a 500-ton, 32-oz. press equipped with four synchronized injection units. Molded by Thermo-Plastics Inc. of Tenite.

In general, tapping on laminates follows the same procedures as for brass, using a small amount of cutting oil to insure a clean cut.

Turning and Boring Operations

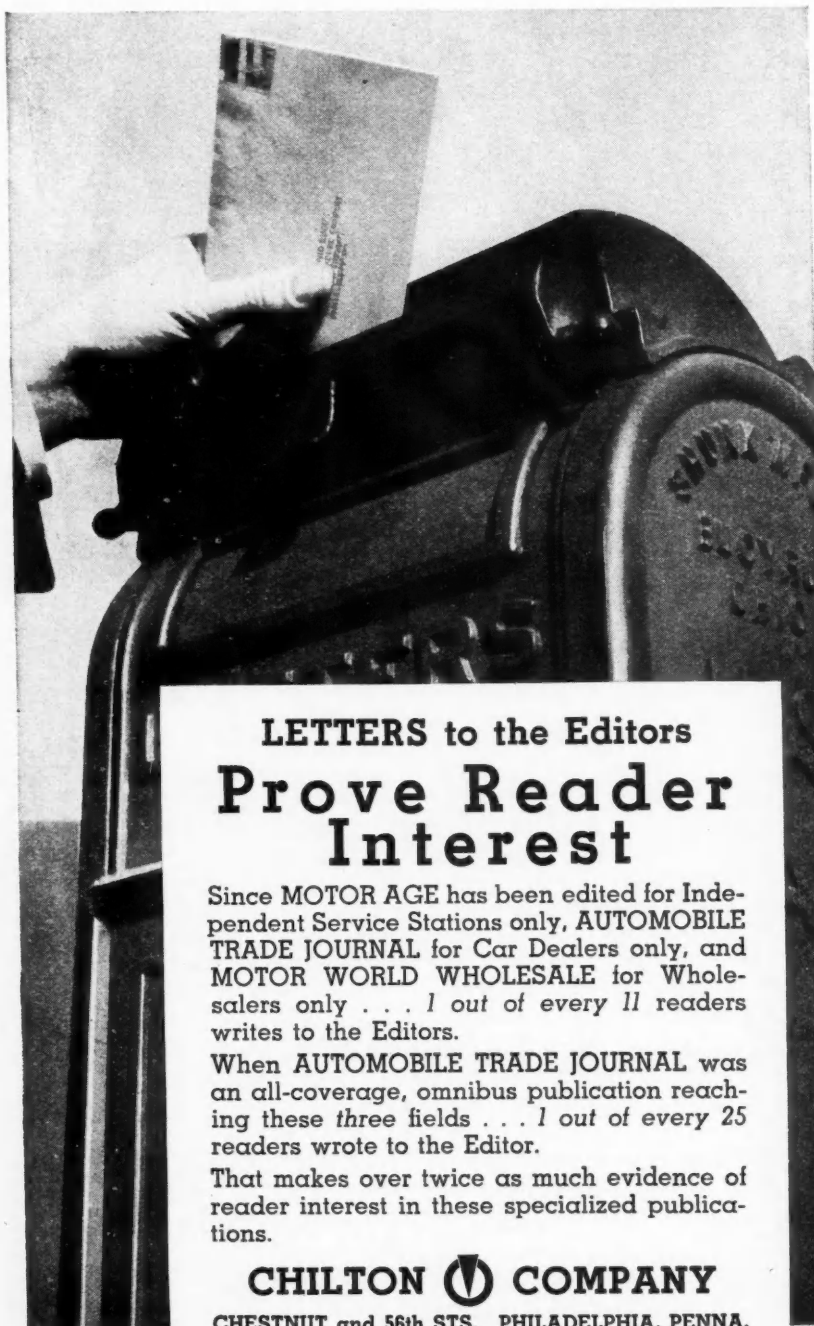
Turning and boring operations present no particular problems. Speeds are usually about 600 ft. per min. when high-speed-steel tools are used and up to 1500 ft. per min. with tungsten-carbide tools. Milling operations like-



Forming of cast resin parts are often done by hand on a grinding wheel such as this. A holding jig provides accuracy and higher production. (Photo courtesy Catalin Corp.)

wise follow standard metal working practices. Automatic screw machines are used to some extent with laminated materials. Usually no lubricants are necessary, but when they are used, lard oil or kerosene is generally adequate.

Perhaps the most common use of laminated materials on automobiles is in the form of gears. The electrical insulating properties and the silent oper-



LETTERS to the Editors

Prove Reader Interest

Since MOTOR AGE has been edited for Independent Service Stations only, AUTOMOBILE TRADE JOURNAL for Car Dealers only, and MOTOR WORLD WHOLESALE for Wholesalers only . . . 1 out of every 11 readers writes to the Editors.

When AUTOMOBILE TRADE JOURNAL was an all-coverage, omnibus publication reaching these three fields . . . 1 out of every 25 readers wrote to the Editor.

That makes over twice as much evidence of reader interest in these specialized publications.

CHILTON COMPANY

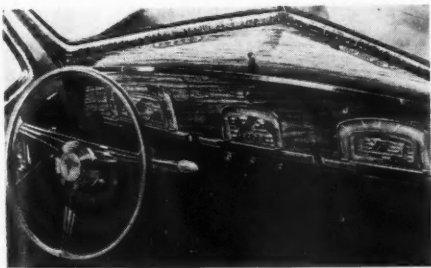
CHESTNUT and 56th STS. PHILADELPHIA, PENNA.

ation of such blanks early gave a place to them in the mechanical parts of the automobile. In fabricating such parts practices found in cutting metal gears are found. Equipment such as milling machines with index heads, automatic single tool gear cutters, hobbing machines and gear shapers are in use. The manufacturers of laminated material have developed special grades for the fabrication of gears having the required dimensional stability, strength characteristics and machining properties. They are now in a position also to provide reliable data as the methods of forming such gears.

In cast resins the present tendency is toward use of special rough castings. Machining from sheets, rods, tubes and bars, however, is still the standard production method for most cast resin parts.

Due to the fact that these stock castings have a slight taper, and since they are seldom available in lengths over 24 in., their applicability to production on automatic screw machines is quite limited. In order to obtain the economy and high production of automatic machines resource is often had to automatic abrasive forming machines. These machines have an arrangement of two parallel abrasive stones 6 in. to 10 in. long and from 4 in. to 6 in. in diameter. One stone acts as a guide and stop and has a flat surface while the other wheel is diamond-cut into the shape of the part. The material, previously cut into convenient lengths, is automatically fed between the stones, where the cutting stone revolves at high speeds. A flood of pure water removes the cuttings and cools the material. Production of parts such as 3/16 in. balls is possible by this method up to 10,000 units per hour.

Cutting of cast resin forms is usually done on abrasive cut-off wheels, where production at high speeds is possible.



This Hudson dashboard has speedometer, radio and clock panels of Lucite, a molded acrylic plastic. (Photo courtesy E. I. du Pont de Nemours Co., Inc.)

In some cases, however, hydraulic or mechanical slicing machines are used. A flow of water is the best lubricant in these operations, and abrasive wheels are usually run at speeds of 3500 to 6000 r.p.m. Sawing cast resin forms may be carried out on circular, jig or band saws, at speeds about 1200 ft. per min.

It will be seen from even a cursory examination of the various plastics in present use, that machining operations

play a more important part in the fabrication of these materials than sometimes thought. While in many cases molding presents the most satisfactory method of obtaining the finished part, the versatility of plastic materials permits of many other methods. Indeed, so diverse are the characteristics of plastics, that discussion of them under one heading is difficult. They might be compared, not with steel, or with glass, or with ceramics, but with all these together, for in each of these cases we are likely to find a plastic which approximates certain properties of one or more of these materials.

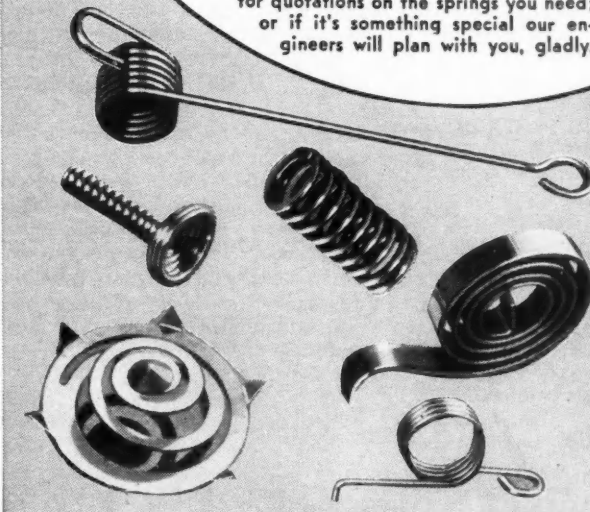
Automobile Financing Off 12.1% in July

The dollar volume of retail automobile financing for July, 1939, is reported by the Bureau of the Census, Department of Commerce, as amounting to \$121,737,141, a decrease of 12.1 per cent when compared with June, 1939, an increase of 47.3 per cent as compared with July, 1938, and a decrease of 30.1 per cent as compared with July, 1937.

The volume of wholesale financing for July, 1939, is reported by the Bureau as \$100,489,515, a decrease of 18.1 per cent when compared with June, 1939.

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WHETHER the springs you use are simple, standard types—or need special engineering—make sure they have the advantage of being Accurate made. A lot of quality and service can be packed into a tiny, hair-like coil. For instance: extra life may be assured by more careful finishing; and perfect uniformity doesn't just happen—it's achieved—by rigid inspection, testing of materials, and control of production methods. When you wisely choose Accurate Springs and find their difference in quality, remember those are some of the "reasons why" they're not just ordinary springs. Into every Accurate product—springs or wire forms—is built the same reliability and guarantee of service. Use them to your advantage . . . it pays to say "Accurate". Ask today for quotations on the springs you need; or if it's something special our engineers will plan with you, gladly.



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1940 Stretches Manufacturing Technique

(Continued from page 301)

omy due to the ability to remove more metal in less time has been achieved by the introduction of the hydraulic honing cycle; spirited developments in this field are promised by the recent entry of a new organization.

Certain of the advances in machine tool designing have evolved from the availability of special cutting tool material such as the cemented-carbides and lower-priced hard cutting alloys such as J-Metal and Stelite-2400. These materials, judiciously employed according to their properties and application, permit of higher speeds, faster feeds, longer tool life, and generally increased overall economy. Recent opening of the magnificent Carboly plant marks a turning point in cemented-carbide production, placing this exacting process on a strictly mass-production basis.

Closely allied with cutting tools are the cutting fluids of various types which are so much a part of efficient metal cutting operations. A new study of the proprietary materials available today will be published in *AUTOMOTIVE INDUSTRIES*, Oct. 15.

It is possible to touch only quickly upon the gamut of the wonderfully intricate and amazingly economical multiple-head, multiple-spindle machines of current designs for drilling, reaming, boring, tapping, etc., and combinations of these. The well-known makes on the market today are responsible to a large degree for the accuracy and low cost of important automotive elements.

Welding in all of its ramifications—resistance welding, the electric arc, the oxy-acetylene torch—is ever widening its influence. Welding techniques of various kinds are used almost exclusively in body fabrication. Newer applications are found in the fabrication of chassis frames, fabrication of parts, assembly of running gear elements. Anticipating a rapid growth of welding applications in a motor car plant, Buick appointed a welding engineer to serve as the contact between the metallurgical laboratory and the factory. This makes possible closer cooperation between these departments, permits a better control of welding procedures, design of fixtures, selection of welding equipment.

In the never-ending search for improved methods of smoothness in every aspect of the car, improved balancing techniques and new balancing equipment are found at every turn. Not content with conventional methods of balancing the reciprocating elements of engines, Buick has pioneered a method of balancing the entire engine assembly after it has been power-tested and inspected. Marked improvement is

promised in vetoing vibrations in the chassis by the use of precisely balanced propeller shaft assemblies, by the use of shorter propeller shafts, by further adoption of slip joint mountings in the transmission end.

Finally, we must make a passing reference to the widespread use of conveyors in all manner of establishments to expedite the smooth flow of raw materials and finished parts. In this category are—assembly conveyors of chain and belt and platform types, monorails for scheduling parts to machine shops and paint shops and assembly stations, gravity roller conveyor for connecting machine operations, industrial trucks and hoists and cranes for handling bulky loads. It is an accepted fact that the modern methods of scheduling passenger car and motor truck lines would be impotent without the aid of such means of expediting the free and smooth flow of materials.

Ourselves and Government

FEDERAL TRADE COMMISSION

FOB PRICE CASE—Testimony closed in GM case. Trial examiners report, which is confidential, has been served on respondent company; the next step will be to hold final arguments after which the FTC will issue its order. Commission charges both Ford and GM engaged in misleading price advertising.

VS. GENERAL MOTORS—Rebuttal testimony concluded in sessions which started on Sept. 11. Trial examiners report in the next development due. FTC alleges that GM dealers are required to handle GM parts to exclusion of others.

SIX PER CENT CASE—Report that cease and desist order to be issued soon still unconfirmed. Order may require abandonment of so-called misleading representation in finance plan advertising and substitution of advertising making it clear present plan does not provide amortization. Involved in the case, on which final arguments have been concluded, are Ford and GM.

FAIR TRADE PRACTICE RULES—No further indication when rules, now long overdue, will be promulgated.

Buick 1940 Price Cuts Range from \$17 to \$281

Price reductions ranging from \$17 to \$281 on nine of Buick's 1940 models have been announced. The Buick range

for 1940 is from \$895 for the 121-in. wheelbase Series 40 Special business coupe to \$2,199 for the 140-in. wheelbase Series 90 Limited limousine.

The new prices include federal tax and are quoted herewith as the retail delivery price fully equipped at the plant of the Buick Motor Division of General Motors Corp. in Flint, Mich.

	1940	1939	Reduction
Series 40 Special			
46 Business coupe	\$895	\$895	....
46S Sport coupe	950	950	....
48 Two door touring sedan	955	955	....
41 Four door touring sedan	996	996	....
46C Convertible coupe.	1,077	1,077	....
41C Convertible Phaeton with under-seat heater	1,355	1,433	\$78
Series 50 Super			
56S Sport coupe	1,046	....	New
51 Four door touring sedan	1,409	....	New
Series 60 Century			
61 Four door touring sedan	1,211	1,246	\$35
66C Convertible coupe	1,343	1,343	....
61C Convertible Phaeton with under-seat heater	1,620	1,740	120
Series 70 Roadmaster			
76S Sport coupe	1,277	....	New
71 Four door touring sedan	1,359	....	New
Series 80 Limited (133 in. wheelbase)			
81 Four door touring sedan with under-seat heater	1,553	1,570	\$17
81F Formal sedan with under-seat heater.	1,727	1,785	58
81C Convertible Phaeton with under-seat heater	1,952	2,010	58
Series 90 Limited (140 in. wheelbase)			
91 Six passenger four door sedan with under-seat heater.	1,942	2,101	\$159
90 Eight passenger touring sedan with under-seat heater	2,096	2,377	281
90L Limousine with under-seat heater	2,199	2,480	281

GM Stockholders Number 387,824

The total number of General Motors common and preferred stockholders for the third quarter of 1939 was 387,824, compared with 388,758 for the second quarter of 1939 and with 399,255 for the third quarter of 1938.

40 YEARS AGO

Four-cylinder motors have hitherto been found less desirable for carriages than one or two cylinder, for the reason that the advantages gained in the lessening of noise and vibration were more than counterbalanced by the increase in the number of moving parts which are liable to get out of order. In the new Vallee (French), however, a great range of power is secured from the four cylinders, rendering a single taut belt of extra width available for transmission. Many of the objections to belt transmission have thus been overcome. From *The Horseless Age*, October, 1899.

1940 Cars Come Through

(Continued from page 298)

rivet is used. The small sketch shows how these pedal blanks are stamped from strip steel without waste of material.

Another design of pressed steel pedal has been developed and may make its appearance on 1941 models. Its lower part is essentially the same as in the accompanying drawing, but the upper end is shaped to accommodate a round rod for the portion extending through the toe-board. The rod is secured to the pressed-steel portion by a clamping method which is claimed to be new in pressed steel technique. These pressed-steel pedals are good examples of the extremes to which engineers are going in developing the design and the production methods of even minor automobile components.

There has been considerable activity in connection with the transmission and its control elements. In the first place, the column-mounted shift lever, which was introduced two years ago, is now practically universal. Some of the earlier designs of "remote shifting mechanism" were not entirely satisfactory. In some cases cable connections formerly used in the shifting mechanism have been replaced by rigid links, while in others the spring pressure behind the locking dogs or balls engaging into notches in the shifter rails has been reduced. On Chrysler lines the shifting has been further facilitated by the introduction of a new type of synchronizer and improved pointing of chamfering of teeth. With remote control of the transmission, shifter arms extend from the transmission housing, to which the control links connect. In the earlier designs these shifter arms projected through the cover or top of the housing, but in order to make possible a lower floor in the driver's compartment, these arms are now brought out through the side.

An improved design of automatic overdrive brought out by Warner Gear Division of the Borg-Warner Corporation this year is offered as standard equipment on a few models, and as an optional extra on a good many others. With this new design the change to overdrive takes place at a much lower speed (around 20 m.p.h.), so that the advantages of the overdrive are available a much greater part of the time, yet the driver has full control over the mechanism and can delay engagement of the overdrive until much higher speeds are reached in acceleration, and can return from overdrive to direct drive at any time, regardless of the speed.

The most outstanding development in the direction in which automobile transmissions seem to be evolving is the Oldsmobile four-speed automatic transmission. It appears to be a development of the transmission with automatic hydraulic control which Olds-

mobile has been offering as an extra for two seasons past, with some of the earlier weak points eliminated and with a fluid coupling added, evidently to prevent shocks in passing from one gear ratio to another. An innovation in the use of the fluid coupling is that instead of being secured to the engine crankshaft, it is incorporated in the transmission beyond the first gear reduction, so that the creeping tendency

of the car with the engine idling is materially reduced. This automatic transmission has four gear speeds, and while it has no overdrive, in combination with a low-ratio rear axle, it offers all of the advantages ordinarily associated with an overdrive. It is standard equipment on one line and extra on the others. We expect to print a full illustrated description of this transmission in an early issue.

Propeller shafts, universal joints, and rear axles have not been altered materially in any case. In the Studebaker Champion there is a Spicer balanced slip joint on the end of the transmission



"SERVICE PROVED" lubricants gave it to MEAD SCREW PRODUCTS COMPANY

D. C. Mead, pressed for time in filling an important customer's order, consulted Cities Service Lubrication Engineers. After a study of his problem, they recommended the correct Cities Service Cutting Lubricant—increasing his production speed 25%, lengthening cutting tool life and helping Mr. Mead turn out a better finish.

You, too, will find our Lubrication Engineering Service a help in turning out work that meets the demands of your most discriminating customers. This service offers you the culmination of a long and varied experience in the solving of many cutting oil problems—plus oils developed as a result of this experience. Let one of our Lubrication Engineers prove the value of these oils to you in your own operations. There is no obligation.



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shaft, and in some of the Chrysler models the grease seal at the wheel bearing of the rear axle has been improved to prevent grease from getting onto the brake linings. In the Chrysler Crown Imperial the differential case has been redesigned to permit of the use of larger differential gears.

Two additional makers—Hudson and Nash—have adopted front independent suspension on coil springs, and independent front springing must now be regarded as the predominant practice at least. Rubber bushings are used more and more in spring shackles and equalizer bars, and rubber-insulated

joints for steering and shock-absorber connections. The direct-acting type of shock absorber has made further gains. It is used on the new Plymouth at both front and rear, and in the Hudson in connection with the new coil front springs. Packard has given up the use of lead-antimony buttons in connection with leaf springs, and now uses rubber and Silenite inserts.

On all models of the Chrysler Corporation a redistribution of weight between front and rear wheels has been made this year, by shifting the axles back relative to the engine. As in each case the rear axle was moved back more

than the front axle, this resulted in lengthening of the wheelbase. Shifting the rear axle back some 7 in. brought the rear seat entirely ahead of the axle. This improved the riding quality of the rear seat, and it also permitted of using rear doors with straight sides, which facilitate ingress and egress. The principal aim in the redistribution of weight, however, seems to have been to increase the moment of inertia of the spring-mounted portion of the car around the transverse axis through its center of gravity, thereby reducing the pitching frequency and improving the riding qualities generally.

In steering gears the aim still is to make steering easier. Formerly this end was accomplished by increasing the steering-gear ratio, but a practical limit seems to have been reached in that direction, and now efforts are directed at reducing steering-gear friction. Chrysler now mounts both shafts of the gear on anti-friction bearings, while on one Cadillac model use is made of the type of steering gear in which the worm and nut are separated by steel balls for which a closed-circuit channel is provided. Steering wheels generally are of rather ornamental design, with spokes so arranged that the driver has a free view of the instruments through the wheel. On the Willys the steering-wheel rim is dropped below the hub, to enable the driver to get a two-hand grip on the two spokes, instead of on the rim.

Brakes remain virtually unchanged. Willys has adopted hydraulic brakes, which makes the use of that type now almost universal on standard-sized cars. In the Chrysler the division of braking effect between front and rear brakes has been changed in accordance with the change in weight distribution.

Where frames have been redesigned, the chief object has been to lower the floor level. Cadillac in a new frame uses side rails of less depth but of heavier stock. Oldsmobile uses a special frame for convertible sedan models that do not benefit from the stiffening effect of a closed body. On the Buick there are full-length engine side pans that fasten to the frame only.

The development of the sheet metal of passenger cars in recent years has been such that it has become almost impossible to insert an ordinary tool-box jack under the axles. Some makers have tried to overcome this difficulty by providing fender jacks, but from the reports of owners this appears not to be a complete solution of the problem. Buick engineers now have attacked it in a different way by supplying a two-unit jacking equipment. The jack itself is inserted under the flange of the wheel rim, and after the wheel is sufficiently raised, a block is inserted under the brake backing plate on the inner side of the wheel. The axle end is then lowered onto this block, by lowering and removing the jack, after which the wheel and tire can be removed.

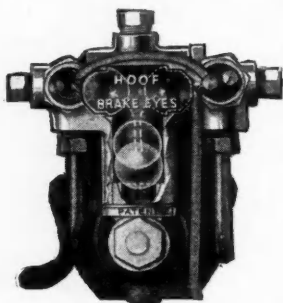
Practically all makes of car this year will have the new "sealed-beam"

Hoof Brake Eyes Capture Public Interest!

**THE PUBLIC WANTS THIS
EXTRA MEASURE OF SAFETY
FOR HYDRAULIC BRAKES**

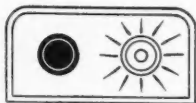
Orders increase daily for Hoof Brake Eyes from School Boards . . . Fleet Operators . . . Car Owners . . . Taxicab Fleets and Public Officials. The action of the State of Washington, in officially approving Hoof Brake Eyes is just one of the many indications of acceptance from safety-minded individuals engaged in public and private enterprise. *Hoof Brake Eyes have CAPTURED public interest because the public wants this extra measure of safety for Hydraulic Brakes!*

When breakage or leakage occurs, through accident or service neglect, Hoof Brake Eyes immediately seal off the brake fluid from the front or rear line (whichever is affected) the moment the brake pedal is depressed, leaving two normally operating brakes in that half of the braking system not damaged. A safe stop is assured.



The Automatic Safety Hydraulic Lock-Out Valve Principle in Hoof Brake Eyes is the ultimate in Safety for Hydraulic Brake Equipped Vehicles.

WARNING SIGNAL ON THE DASH



Hoof Brake Eyes enable the driver to "see" safety at all times by means of a double light indicator on the dash. Both lights flash when the braking system operates normally. But when front or rear

brake fail—one light goes out warning the driver immediately when and where trouble has occurred.

HOOF BRAKE EYES
For SAFER Hydraulic Brakes
PATENT NO. 2,105,749

HOOF PRODUCTS CO., Dept. BE1, 6543 S. Laramie Ave., CHICAGO, ILL.

Makers of the FAMOUS HOOF CANTILEVER GOVERNORS.

headlamps. The principal feature of this lamp is that the light source, reflector, and lense form a sealed unit which must be replaced as a whole when the bulb is burned out. It has been the general experience that the intensity of illumination produced by the headlights drops rapidly with increase in age. The chief cause of this decrease in illuminating power is the drop in efficiency of the reflector due to atmospheric influences. To prevent this loss in efficiency, the reflector must be perfectly sealed, and a perfect seal cannot be maintained if it has to be broken every time a bulb must be replaced.

The new lighting unit is claimed to give more light initially than previous headlamps, and to maintain its efficiency well throughout life. It will be manufactured by different firms, but units of all makes will be interchangeable and will fit the lamp shells of all cars designed to use "sealed-beam" headlamps. The lamps give two beams, and the change from one to the other is made by means of a switch operated by the left foot of the operator. In city driving and in the country whenever other vehicles are approaching, use is made of the "traffic beam." With this beam the light is well distributed to the sides of the road, the right shoulder especially being well illuminated, and there is practically no glare. The second, or upper beam, referred to as the "country beam," is for use on the open highway where there is no other traffic. It throws the light a considerably greater distance down the road than former types, and clearly outlines road shoulders, warning signs and fences. At the same time it enables the driver to see overhanging obstacles such as branches, overpasses, etc. To remind the driver to make the change to the "traffic beam" whenever road conditions call for it, a signal lamp on the instrument board glows red as long as the "country beam" is in use. The light switch on the instrument panel has only two positions. In the first the parking and signal lights are turned on; in the second, the headlights. This new headlighting system seems to be a great step in advance, in regard to both maintenance of lighting efficiency and standardization of control. The one thing that remains is the education of drivers to its proper use, and an educational campaign has been undertaken by the sponsors of the system.

In all lines of the Chrysler Corporation the tail lights light the interior of the luggage compartment at night. They are mounted in the rear wall of the compartment on opposite sides of the cover or lid, and throw light through openings in this wall. On the Chrysler and Dodge the license-plate light, luggage-locker lid and lock form one unit.

Car heaters are standard equipment on only very few cars, because in some sections of the country there is no need for them; but practically every maker offers a heater as extra factory equip-

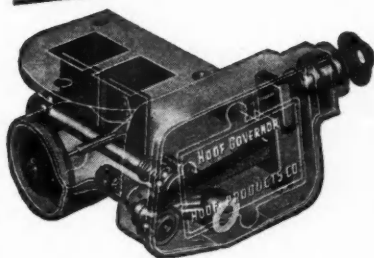
ment. At first exhaust-gas heaters were used, installed in the floor of the body, but they were open to the objection that with increasing age they tended to become leaky and allowed exhaust gases to enter the body. They were replaced by hot-water heaters installed on the dash. These have electric fans combined with them that circulate the air through the heater, but the effect in the rear compartment of sedans often is inadequate. This has led to the use of so-called underseat heaters. The front seat is made with a tubular frame, under which the heater is installed, and the latter is so arranged that it delivers about the same amount

of heat to both compartments. These underseat heaters are being provided for in an increased number of car models. For very cold districts Buick even offers double heater equipment (dash and underseat). Buick, as already mentioned, has adopted pressure cooling, which, by raising the temperature of the water as it leaves the engine jackets, renders the heaters more effective.

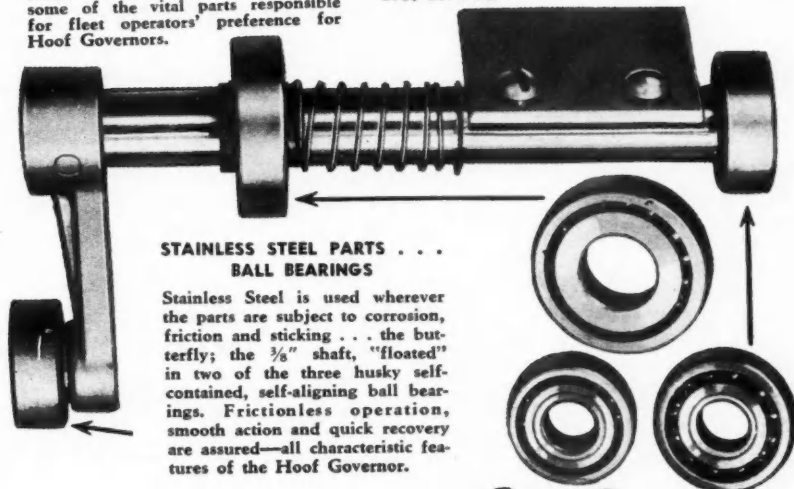
Running boards seem to be definitely on the way out. In order to ease the transition, many makers this year offer their cars with or without running boards at the option of the purchaser. The constant lowering of floors has made a step unnecessary, and the elimi-

Hoof Governors Win Fleet Operator Preference

NOW STANDARD OR OPTIONAL EQUIPMENT ON 1940 TRUCKS



Illustrated below, in actual size, are some of the vital parts responsible for fleet operators' preference for Hoof Governors.



STAINLESS STEEL PARTS . . . BALL BEARINGS

Stainless Steel is used wherever the parts are subject to corrosion, friction and sticking . . . the butterfly; the $\frac{3}{8}$ " shaft, "floated" in two of the three husky self-contained, self-aligning ball bearings. Frictionless operation, smooth action and quick recovery are assured—all characteristic features of the Hoof Governor.

HOOF EXCLUSIVE CANTILEVER SPRING

Cantilever Spring combinations are made to accommodate the characteristics of any engine at any desired governed speed, without affecting the power of the engine up to the governed speed. Not subject to stretch or fatigue . . . maintains factory calibration . . . self-dampening—eliminates use of cams, pistons and dash pots.

OTHER FEATURES

The patented lock-in cover plate—*Tamper-proof!* The diaphragm control, preventing over-running by part throttle manipulation . . . each special calibrated governor tested for power and performance on dynamometer.

HOOF PRODUCTS CO., Dept. BEI, 6543 S. Laramie Ave., CHICAGO, ILL.

Makers of the FAMOUS HOOF CANTILEVER GOVERNORS.

nation of the running boards has made it possible to so increase the interior width of seats as to ensure comfort for three passengers side by side. Time was when "full-length running boards" was a feature on which much emphasis was laid by salesmen, but time changes all things, and running boards now seem to have become a negative virtue.

Some years ago there was much complaint regarding insufficient visibility. High engine hoods, low seats, and windshields of inadequate depth restricted the driver's field of vision and increased the hazards of the road. This year definite steps have been taken to elimi-

nate this objection. Windshield depths have been increased on many cars, among others on the Hudson, Pontiac, and Studebaker. On some of the Chrysler Corporation lines and on the Lincoln Zephyr the window area has been increased all around. On quite a number of models, including the Hudson, Lincoln Zephyr, DeSoto, Chrysler, Dodge, Buick and Pontiac, the rear window is made of heat-tempered glass and is curved to conform to the shape of the body rear panel.

This year a new type of safety glass, known as Hi-Test safety glass, has been introduced, which already has

come into wide use. Like the earlier type, it is of laminated construction, comprising two sheets of glass and an intermediate layer of a transparent plastic material. Formerly the sandwiched layer consisted of cellulose acetate, while now polyvinyl acetal resin is used. The new glass is said to be six times as strong as the old at zero Fahr., and of the same strength as the latter at 100 deg.

This new safety glass comes in two forms. One of these is made up of plate glass, in which both sides of the glass sheets are ground and polished, while the other is made up with sheet glass. The plate glass, of course, is superior, because, being devoid of the slight surface irregularities of the sheet glass, it reduces eye fatigue. Some car makers use safety plate glass all around, while others use it only in the windshield. This accounts for the emphasis that is laid on Hi-Test safety plate glass in specifications this year.

The new type of safety glass costs about the same as the old, but the layer of plastic is only 0.015-in. thick, instead of 0.25-in. It is hinted that with the prospective lowering in cost of the polyvinyl resin (which is a relatively new synthetic product) the thickness of the center sheet will be increased, which would further increase the margin of safety.

Stone shields or gravel deflectors are a relatively new item of stock equipment. They are found between the rear bumper and body on all of the lines of the Chrysler Corporation. On the Pontiac there are triangular molded-rubber stone shields at the rear edges of the front fenders. Concealed hinges on front doors are becoming more general.

There is a definite tendency toward the rotary type of door lock. This lock, pioneered by Studebaker, has been adopted this year by Hudson and the Chrysler Corporation. In the past on most makes of cars only the front door on the right side could be unlocked from the outside. This involved certain inconveniences, and more cars this year have locks in both front doors. On certain of this year's Buick models the rear-door locks are said to be "free-reeling"; that is, the locks are inoperative when the "remote-control" lock knob is down.

Sponge-rubber or latex-foam seat cushions, introduced about two years ago, have gained further adherents. Sponge rubber is used in combination with the regular foundation of nested coil springs. The combination apparently makes a superior seat cushion and is offered particularly in higher-priced models. For instance, it is standard equipment in the two higher-priced Nash series, and extra equipment in the lower-priced series. Packard and Cadillac also use such cushions.

In all of the Chrysler-Corporation lines the spare tire this year is mounted vertically at the right in the luggage compartment. This has the advantage that luggage need not be unloaded when



A tire valve must be judged, not alone by its performance under ideal conditions, but also under the extremes — when the going gets tough — under scorching heat, freezing cold, dirt and mud. Only the tire valve that is air-tight under all conditions can provide the protection that modern tires must have.

Schrader Tire Valves are engineered with the experience of forty years, to meet the toughest conditions that modern driving can produce — many so severe that only the air-tight cap can assure perfect performance.

To the tens of millions of tire users, the replaceability and low cost of Schrader Valve Cores and Caps are the most practical assurance of air-tight tire valves under every operating condition.

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TIRE VALVES



THE STANDARD FOR EQUIPMENT AND REPLACEMENT

it is desired to remove the spare tire. While on the subject of luggage-storing facilities, it may be mentioned that Willys this year offers a trunk lid as an optional extra, on which additional luggage can be carried. All Nash cars may again be had with either trunk-back or streamlined bodies.

Packard this year offers a convertible model with an engine-operated top mechanism. DeSoto has added a convertible to the Custom series. A convertible sedan has been added to the Mercury line, and two body styles have been added to the Lincoln Zephyr line—a club coupe and a Continental cabriolet.

The type of luminous direction signal introduced by Buick last year, which flashes front and rear lights on the side toward which a turn is to be made, if the operator throws a conveniently-located switch, seems to be appreciated by operators; it is this year being offered as standard equipment also on Cadillacs, and as extra equipment on Hudsons, Oldsmobiles, and Pontiacs.

The so-called safety speedometer with colored sections on the dial face indicating definite speed ranges, is found on a number of additional models. A new safety feature introduced this year on all lines of the Chrysler Corporation consists in reminder lights adjacent to the four indicators found on most instrument boards, which by flashing red, warn the driver that his fuel supply is running low, his battery is not charging properly, there is insufficient pressure in the lubricating system of his engine, and that the temperature of the cooling water is excessive. The speedometer on the Packard has a pointer of lucite, a synthetic resin having unusual light-conducting properties. A small electric bulb at the rear of the instrument makes the pointer light up and facilitates reading of the speedometer at night. The speedometer on the Hudson has a separate odometer dial with a magnifying lens which facilitates readings at night.

Electrically-operated windshield wipers are now fitted on Chrysler, Dodge and Packard cars. These have the advantage that their speed of operation is independent of the load on the engine. Features of the Chrysler electric wipers are two-speed control and automatic circuit breakers which act in case of excessive resistance to the movement of the blades, as when sleet forms on the windshield.

Studebaker 1940 Models

(Continued from page 305)

on Studebaker cars last year, is continued for 1940, with a larger core and larger fan capacity. A detail change has increased the sensitivity of its regulation.

All models are now fitted with the

"remote-control" gearshift that appeared first on the Champion last year. Its adoption to the Commander and President models necessitated a change in the transmission, to bring it into line with that used on the Champion. This change consisted, in effect, in rolling the housing back so that the cover is on top again, with the shift levers coming out the side.

On the Champion with standard transmission the propeller shaft design has been changed. A Spicer balanced slip joint now is mounted on the end of the transmission main shaft. This eliminates the slip joint in the propeller shaft itself, which permits of a better

balance of the entire assembly.

More rubber is used in this year's models for mountings and connections. The pitman arm of the steering gear now has rubber bushings for the connection to the drag link. Harris bushings have been adopted for the rear-spring shackle mountings on both the Commander and the President. The over-all reduction in the steering mechanism has been increased, by changes in the gear ratio and the leverages, in both the Commander and the President.

On the Commander, 6.25 x 16 tires are now used, instead of 6.00 x 16, this being the only change in the wheel and tire equipment.

"It takes all kinds!"

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BENDIX Drives

STAINLESS STEEL

(Continued from page 318)

oxidation and to many forms of attack by chemicals and confers strength at high temperatures that is unequalled by any other of the commercially available metals or alloys. Corrosion resistance increases with the percentage of chromium from about 5 per cent to as much as 30 per cent. Less than 11 per cent confers little resistance to pure iron, and a steel alloyed with only 6 per cent does not resist atmospheric attack enough better than ordinary iron

to warrant the chromium addition. About 1 per cent of chromium is added for each increase of 5 points in carbon content of the iron in order to maintain comparable corrosion resistance.

Susceptibility to hardening depends upon percentages of chromium and carbon contents. Either increase of carbon or decrease of chromium increases the hardenability. Thus, a steel with a content of only 0.08 per cent carbon and 12 per cent chromium can be hard-

ened to approximately 400 Brinnell. If the chromium is increased to 18 per cent, it can be hardened to only about 200 Brinnell, but a steel of 0.60 per cent carbon and 18 per cent chromium is hardenable to more than 500 Brinnell. Hardening temperatures range from about 1400 to as high as 1850 deg. Fahr. before quenching. The chromium irons and steels are magnetic at atmospheric temperatures.

Addition of nickel in sufficient amount makes the chromium-iron alloys very strong and tough and renders them non-magnetic at room temperature. It also makes them hardenable by rolling but not by heat treatment. Ferritic chromium-nickel irons containing only 0.60 to 1.00 per cent nickel are heat-treatable. Austenitic non-treatable alloys vary in nickel content from 7 to as much as 20 per cent according to properties desired, but usually from 8 to 14 per cent.

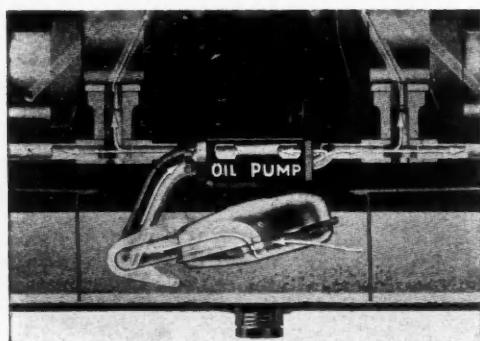
Steels of various compositions ranging from 0.08 to 0.25 per cent carbon, 17 to 26 per cent chromium and 7 to 21 per cent nickel have melting points of 2600 to 2700 deg. Fahr., hence are suitable for applications requiring high heat resistance, as engine valves. They also possess excellent corrosion resistance and, when annealed, an ultimate strength of 80,000 to 110,000 lb. per sq. in.

The most generally used grade—18-8—with about 0.10 to 0.20 carbon, 17-19 per cent chromium and 7-9.5 per cent nickel, is hardenable by annealing, cold drawing or hot rolling to ultimate strengths of 80,000 to 250,000 lb. per sq. in. according to method of treatment. Steels of 0.30 to 1.00 carbon, 12-18 chromium and no nickel can be given an ultimate strength of 90,000 to 125,000 lb. per sq. in. by annealing and of 130,000 to 250,000 by heat treating.

Several other alloying elements are employed to give the numerous grades of chromium-nickel steels specially desired properties, particularly greater resistance to carbide separation at elevated temperatures and hence to corrosion. The chemical composition of virtually all the irons and steels include sulphur and phosphorus to a maximum usually of 0.03 per cent, silicon from 0.50 to 3.00 per cent maximum, and manganese 0.50 to 1.50. Addition of molybdenum, titanium or columbium to 18-8 steel in small amounts prevents precipitation of carbides at grain boundaries and hence eliminates susceptibility to intergranular corrosion at temperatures above 1500 deg. Fahr. From 2 to 4 per cent of molybdenum gives increased resistance to attack by acids. Selenium in an amount of 0.07 per cent or more contributes to free-cutting properties and facilitates machining operations.

Methods of Fabricating

Almost every method of metal working can be applied to stainless 18-8. It can be forged, hot or cold-rolled, drawn, machined, riveted, welded, soldered and polished to a mirror-like surface untar-



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Cadillac-La Salle	
Chrysler	Otto Engine
General Motors Corp.	Packard
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Gen'l Motors of Canada Ltd.	Seagrave Corp.
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	White Motors
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Other prominent builders definitely committed for 1941 models.

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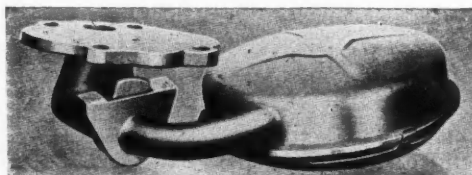
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the top of the Crank Case

The sludge, filings, and heavy abrasives which cause serious engine wear and inefficiency naturally precipitate to the bottom of the crank case. FLOAT-O installed at the pump intake, draws horizontally from the clean oil found at the top — it does not disturb the harmful substances found at the bottom of the crank case. With FLOAT-O only this "cream" of the oil sump is distributed to the bearings. This is true during starting and all running conditions. FLOAT-O is also a definite guarantee against ice locking.

Indorsed and approved by the leading research engineers of the industry, FLOAT-O insures quicker starting, smoother operation, and longer life for engines.

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nishable in moist air. It cannot be forge or hammer welded but is readily amenable to gas and electric welding. Electric arc welding is preferable to gas welding particularly with light gages, because of the low thermal conductivity and high coefficient of expansion, which may result in warping and buckling with the application of heat to a considerable area. Flash and spot welding are especially suitable for this metal.

The 18-8 chromium-nickel steels have high elongation characteristics—up to 50-60 per cent in the annealed or cold-drawn state—so are excellently suited for shearing, blanking, punching and deep-drawing operations. However, as they harden rapidly under working, about double the power is required for drawing them as for ordinary steels. Also, the steels of higher alloy content flow slowly under either hot or cold forming, so the speed of draw should be only about one-half to obtain deep draws and avoid damage to dies.

Budd trailer and body construction, using 18-8 stainless steel, involves new engineering principles and fabricating methods that result in a great saving of weight. Semi-trailer frame and body are welded into an integral unit having no bolts or rivets. Corrugated body sides and horizontal trusses in the plane of the floor carry the load. Although stainless costs four to five times as much as mild steel, it has about 30 per cent more tensile strength, so an almost equivalent saving in metal can be effected where the same forms of construction are employed. Compared with duralumin, stainless steel weighs approximately three times as much by volume but is three times as strong. The moduli of elasticity of the two are about the same. Weight for weight, the aluminum alloy has much greater rigidity than the steel alloy because of its greater thickness of section.

To match this superior stability with the thinner steel, Budd forms the structural members of readily fabricated strips which, when assembled, become built-up tension and compression elements. Strips from $\frac{1}{4}$ to 24 in. wide are shipped by suppliers in rolls containing continuous lengths of several hundred to 2000 ft. The strips are passed through forming rolls to corrugate them for paneling or to give them a desired cross-section shape for the construction of beams. Pieces of the exact length required are cut from the strip as it issues from the rolls, thus avoiding the waste that occurs when using standard lengths of steel sheets or tubes.

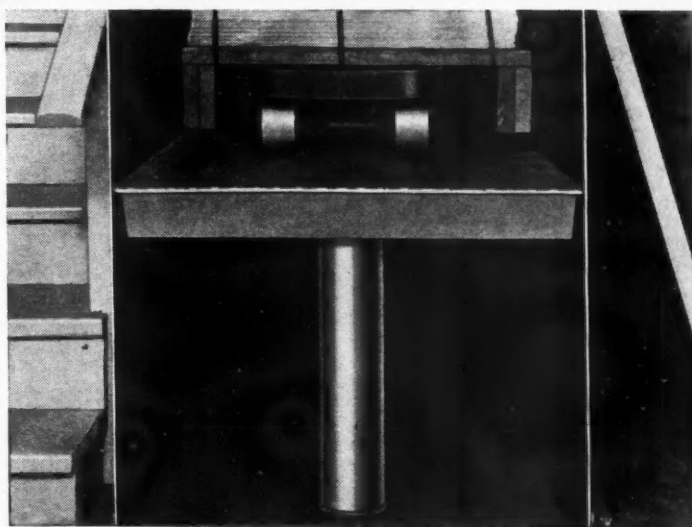
Formed sections usually are shaped so they can be placed with side flanges back to back to produce a box section to withstand compression. Metal between the flanged edges is rolled to have narrow longitudinal flats. Most truss work is built up of strip 0.05 in. thick, but corrugated flooring and paneling may be of 0.02 in. material. A basic tension diagonal of U shape, 2 in. wide on each side, made of 0.05-in.

strip, has a cross-section metal area of 0.30 sq. in. A $\frac{1}{8}$ -in. wide strip welded in the bottom of the U increases this to 0.50 sq. in. Then, by welding a $\frac{1}{8}$ -in. strip between edges of the U shapes when they are placed edge to edge, the area becomes 0.80 sq. in. But the strength of the member is more than doubled, and so is the area for attachment where the diagonal fits between twin gusset plates.

The underlying principle in Budd design engineering is to avoid or reduce the use of metal that is not stressed and merely adds unnecessary weight. Box sections reinforced with transverse

strips and lateral flanges serve this end. Corrugated panels welded to flat sheets form a truss cross-section of great rigidity and strength relative to amount of metal used.

Strength is further increased, labor and weight saved and deterioration of the structure delayed by welding all parts into an integral whole by the "Shotweld" method. In this process overlapping edges of the pieces are gripped between the peripheries of two copper-disk electrodes and a make-and-break electric current is passed through them, fusing the metal together at a succession or string of closely spaced



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spots resembling stitching as the seam passes through the welding machine. Each "shot" has a duration as little as 1/120 sec. A recording device on the machine draws a line automatically on a paper tape which indicates the strength of the seam as welding proceeds. Warning is given by a bell if too little or too much current is being applied. As many as 1000 weld spots can be made in 1 min. or so at a cost of probably 5 to 10 cents.

Final assembly of individual sections, which are few in number, is by hand welding. This is much slower—from 10 to 40 welds per min.

PUBLICATIONS

The 1939 catalog and data book of Elastic Stop Nut Corp., Elizabeth, N. J., contains a description of the Elastic Stop principle, comparative test data, suggestions for applications of Elastic Stop Nuts, numerous illustrations, and a complete listing of the standard nuts available.*

A comparison of relative building and operating costs in single story and multi-story industrial buildings, and a discussion of their relative advantages and disadvantages, is presented by the Austin Co. in the fifth edition of its booklet, "Your New Plant—Multistory or Single Story—Which?"* Must Oct. 1 Issue—Catch

A pioneering step in employee relations is the "President's 1938 Report to Employees" released by Clark Equipment Co. This profusely illustrated, handsomely bound report of 31 pages contains a complete story of company history, products and finances presented in an unusually effective manner.*

A comprehensive 40-page bulletin entitled "Let Your Tires Roll" has been issued by Fruehauf Trailer Co. The bulletin tells the story of differential dual wheels.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Prices Announced On 1940 Plymouth

New Detroit delivered prices for the majority of its 1940 models have been announced by the Plymouth Division of Chrysler Corp. The prices, including all Federal taxes, are as follows: "Roadking"—Coupe, \$645; Two-door touring sedan, \$699; Four-door touring sedan, \$740; DeLuxe—Coupe, \$725; Four-passenger coupe, \$770; Two-door touring sedan, \$775; Four-door touring sedan, \$805.

Dodge Reduces Prices On Several 1940 Models

Prices for 1940 Dodge passenger car models, showing decreases up to \$15, as compared with prices of three comparable models for 1939 and no change on other 1940 models, have been announced by Dodge Division of Chrysler Corp.

For 1940 the Detroit delivered prices, including all federal taxes, are as follows: Special—Coupe, \$755; Two-door sedan, \$815; Four-door sedan, \$855; DeLuxe—Coupe, \$803; Four passenger

coupe \$855 (\$5 reduction from 1939); Two-door sedan, \$860 (\$5 reduction from 1939); Four-door sedan, \$905; Seven-passenger sedan, \$1,095; Seven-passenger limousine, \$1,170 (\$15 reduction from 1939).

Eight More Manufacturers Affiliate with the MEMA

Eight more manufacturers of automotive products have become affiliated with the Motor and Equipment Manufacturers Association either as members or credit subscribers. The following are the names of the companies: The Air-Flo Corp., Boston, Mass.; Dover Stamping & Mfg. Co., Cambridge, Mass.; Fleming Mfg. Co., East Providence, R. I.; Hunter-Hartman Corp., St. Louis, Mo.; Standard Motor Products, Inc., Long Island City, N. Y.; S. G. Taylor Chain Co., Hammond, Ind.; Tobin-Arp Mfg. Co., Minneapolis, Minn.; Wilkening Mfg. Co., Philadelphia, Pa.

Molds and Dies by Electro-Deposition

(Continued from page 315)

"electroforming." The engraved mold, after the addition of a spacer ring, is used to mold the pattern, which is later covered with iron by electro-deposition.

Fig. 2 shows an electroformed pattern or matrix which has been obtained from an engraved mold. The extra-width portion of the tread design is due to the spacer ring in the original mold, and provides the necessary material at the parting line for the machining operation by which the "electroformed" shells are separated from the pattern. Obviously, if no extra width were provided at the parting line the removal of metal by the tool used to cut the shell in halves would result in making the cavities too shallow.

In the Ekko process the pattern is rendered conducting by dusting it with powdered graphite and vigorously polishing it. This polishing operation improves the finish of the "electroformed" cavity obtained. One reason the electroformed tire mold comes cheaper than one produced by the conventional method is that it can be mounted in a watch case from a mold of obsolete design.

Demonstrating the Ekko process at Chicago recently, Dr. E. H. Wallace of the U. S. Tire Co., stated that the iron produced is 99.98 per cent pure and substantially free from porosity. It is about 50 per cent harder than cold-rolled steel, giving a scleroscope reading of 37 and a Brinell reading of 240. By annealing, the metal can be rendered as soft as normal pure iron, and

Truck Show Publicity Committee Appointed

Announcement of the appointment of the publicity committee for the Sixth Annual National Motor Truck Show, to be held in Chicago, Nov. 8 to 16, has been made by J. F. Winchester, president and general manager of the show.

The committee is as follows: L. C. Allman, vice-president and director of public relations, Fruehauf Trailer Co., chairman; Harry E. Slater, vice-president, Thornton Tandem Co., F. M. Higgins, advertising manager, Four Wheel Drive Auto Co.; P. C. Ritchie, advertising manager, Waukesha Motor Co.; John F. Creamer, president, Wheels, Inc.; D. W. Scott, advertising manager, Bendix-Westinghouse Automotive Air Brake Co.; Russell R. Hughes, advertising manager, The Buda Co.; H. F. Pugh, advertising manager, The Heil Co.; and Merrill C. Horine, sales promotion manager, Mack-International Motor Co.

Schipper Associates of Detroit will handle publicity and advertising.

it can be made sufficiently hard to scratch glass by carburizing and quenching. Electrolytic iron has a heat conductivity nearly twice that of cast iron or steel, which is an advantage in molding operations, since the heat required for such operations must be transmitted through the walls of the mold to the material within it.

Another interesting fact in connection with the electroforming process is that the patterns on which the iron is deposited need not be of rubber, although the latter is used in the preparation of tire patterns. Wood, plastics, glass, or any similar material can be used. However, wood patterns with fillets of bees wax are unsuitable since the heat of the electrolytic bath melts the wax. In such cases it is customary to make a plaster cast of the pattern. Any metal can be used for the shells, except aluminum and zinc, which latter are attacked by the plating bath.

How the process is applied in making dies for molding operations is illustrated in Fig. 3. With a bakelite radio dial as a pattern, the die shown at the right was electroformed. The plated metal is approximately 1/4 in. thick and can be mounted for use by machining the back to a suitable shape and inserting the electroformed die in a steel block which has been bored out to receive it. The other half of the mold is not shown, but it can be produced and mounted in the same manner. In the mold, the dial scale and numbers are raised. Such raised characters are

difficult and costly to produce by engraving, as the metal surrounding each scale division or number must be cut away. By the electroforming process such raised letters can be produced as easily as depressed letters.

Fig. 4 illustrates an application of the Ekko process in the glass industry, where dies are subject to severe operating conditions. At the right is shown an engraved plunger as used to stamp headlight lenses from semi-molten glass. A rubber negative was molded against this plunger, and served as a pattern for the electroformed duplicate shown at the left. The accurately machined face of such a die is both difficult and costly to cut by the usual method. With the electroforming process, duplicates can be made much cheaper.

In the demonstration by Doctor Wallace, he showed a further application in the production of reflectors which owe their optical properties to an arrangement of prisms having accurately determined angles, polished faces, and sharp edges. It is impossible to produce by engraving a mold which will give reflectors having these characteristics, as engraving machines cannot cut accurately the sharp corners and angles into a depression. Furthermore, it would be impossible to polish the many-angled faces at the sides of the depressions. In the preparation of reflector molds, a master is made by clamping together a great many metal rods which have been cut and polished to the proper angle at one end. Metal is electroformed on the face of this master, and a mold is produced.

For the preparation of decorative designs and figures in relatively shallow relief, it is not necessary for the customer to supply a three-dimensional pattern for the Ekko process. Through an arrangement with the Ford Ceramic Arts Process, Columbus, Ohio, the United States Rubber Company secures a three-dimensional relief made in plaster from a photographic negative or black-and-white drawing, and this in turn can be used as a master for the electroforming process.

Research on Oil Filters

Dr. Edward R. Weidlein, director, Mellon Institute, Pittsburgh, has announced the establishment of an industrial fellowship in that institution by the Fleming Manufacturing Co., Providence, R. I. This fellowship will study the design, construction, and operation of oil filters. One aim will be to obtain new knowledge to bring about improvements in the products of the donor.

Dr. Glenn O. Ebrey, who has been appointed to the incumbency of the fellowship, received his professional education at Illinois College (B.S., 1924) and at the University of Pittsburgh (Ph.D., 1931). During 1931-32 he was research chemist with the Sinclair Refining Co., research and development division, East Chicago, Ind. For the past seven years—up to July, 1939—he was chief chemist of the Pennzoil Co., Oil City, Pa.

Triumvirate for Achievement

(Continued from page 294)

ufacturing and sales organization, still one of the best in the industry but dispirited by lean years of low volume, required development.

It was not expected to transform the great Buick factories overnight. Sights were set on an ambitious future objective. It was a long pull objective involving tremendous revision of manufacturing methods and capacity, engineering and design, and sales organization. In inaugurating the pro-

gram full advantage was taken of recent machine tool developments, and research facilities of various parts makers were undoubtedly an aid. Thus the three—car manufacturer, machine tool builder, parts maker—each working to its own advantage while pooling their skill, combine to produce immediate and future benefits whose economic significance extends far beyond the usual sphere of automotive activity.

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From B. H. Fuller

Subject: FAYLOR CHAIN

Abstract: Examined
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customer.
Returned
Six sets

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advised us that
with 8 sets of
on their docks
handling all
have been in

The entire
for inspection
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